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FORECAST-REVIEW

THE INDUSTRY'S STANDARD

ISSUE

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February 15, 1960

In the United States this year . . .

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WORLD OIL

SPECIALIZED FOR EXPLORATION, DRILLING AND PRODUCING OPERATIONS AND MANAGEMENT

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WORLD OIL

Volume 150, No. 3 February 15, 1960

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a Quick Look at this issue—WORLD

BUSY OIL MEN: To help you put first things first, scan these time-saving digests, checking ☑ those you want to read first.

☐ **The changing panorama, 1959-1960 . . .** New record volumes of business are in prospect for the oil and natural gas industries in 1960. Increases in operations will continue those of 1959. Possible improvement of prices and increased sales should afford good results. Page 25

☐ **Tabular summary of forecasts for 1960 . . .** Tables show concisely that oil and gas industry operations are expected to expand generally in 1960. They also show that operations in 1959 were vigorous, with oil and gas demand, production and sales increasing over 1958 levels. Page 25

☐ **High crude output needed to supply record demand . . .** Demand for petroleum is expected to increase 3.8% in 1960, the same as in 1959. Record U.S. crude production will be required. Imports and natural gas liquids production will be expanded somewhat. Page 81

☐ **Gain in U.S. drilling in 1960 forecast . . .** In prospect: correction of oversupply problems, larger demand, more stable markets, and easing of tight proration schedules. As a result: 1.4% more U.S. wells and 1.8% more footage than in 1959 will be drilled. Page 84

☐ **U.S. imports to increase while exports decline . . .** Postwar trends of increasing oil imports and decreasing exports will continue. In 1947 exports exceeded imports. Since then the country has been a net importer. Its growing net deficiency now exceeds 1½ million barrels daily. Page 87

☐ **Stocks situation improves slightly . . .** The industry currently has reasonable oil inventories. In terms of days' supply at prevailing consumption rates, stocks are generally lower than one year ago or two years ago. Page 88

☐ **Oil and gas using units increase at slower rate . . .** Motor vehicles, farm tractors, and other oil and gas using units continue to increase in number. But growth rates have decreased, particularly for railroad diesels and home oil burners. Page 89

☐ **U.S. crude production to set new record in 1960 . . .** Because of unprecedented demand for petroleum products, producers will have a market for record crude production of 7,427,000 barrels daily, up 385,000 barrels or 5.5% over near-record 1959. Page 90

☐ **Natural gas production and use are steadily expanding . . .** More potential customers want natural gas, and it is being provided through vigorous expansion of pipe line systems and other facilities. Producers will have a ready market for a new record volume of output in 1960. Page 92

☐ **World crude production to climb again in 1960 . . .** Yield will exceed 20.7 million barrels daily, up 6.6% from 1959. Russia overtook Venezuela in 1959 as No. 2 producer; may widen margin. Sahara crude may hinder Middle East. Page 94

☐ **Steadier crude oil prices are in prospect following declines . . .** The U.S. average price of crude oil at the well declined to $2.94 per barrel in 1959

Three New Features

1. New drilling equipment and methods

2. Progress in production techniques

3. Exploratory work in prospect, by areas

Your particular attention is directed to these new, timely articles. They have been added to the many established features of earlier Forecast-Review issues

☐ **What's new in drilling . . .** During the past year the drilling industry has witnessed considerable technological advances in equipment and methods. A new drilling technique, which includes a dual drilling string, reverse circulation, power swivel and recovery of a continuous core, was first introduced in the latter part of the year. Other new advancements included a means of shutting off water encroachment during air and gas drilling operations, a new bottom-hole orienting sub, new hydraulic rotating subs and swivels, and bottom hole percussion hammers. These along with other techniques are discussed. Page 131

☐ **Exploration outlook—1960 . . .** Geologists reporting from all oil-prospective areas in the United States have generally reflected an optimistic outlook for exploration this year. Areas of primary interest are the Paradox Basin, where Good Mississippian, Devonian, and possible new Cambrian pays have been discovered in Utah and Colorado; south Louisiana, extending offshore; offshore from California; the Sacramento Valley gas play; central Kentucky; and western Pennsylvania, where elongate Appalachian structures continue to be proved up for Oriskany-Onondaga gas.

OIL'S annual Forecast-Review Issue

Initiated This Year

As part of a vigorous effort to extend its coverage of exploration activities, WORLD OIL this year has renewed the domestic exploration forecast feature, which was carried in Forecast-Review issues published previous to 1955.

Consulting and/or state geologists all over the country have been contacted for their views as to 1960's prospects. Their reports have been condensed and insofar as possible credited in this feature.

Concisely prepared maps of the United States, and of the sedimentary basins and oil and gas fields of Wyoming and Michigan accompany the text of this well rounded and well illustrated article.

Exploration in the United States is still vigorous and still of utmost importance. Through this feature article, petroleum geologists in different U.S. areas tell the rest of WORLD OIL's readers where the new oil and gas is being found. Page 155

☐ **Advancements in production methods—1959 . . .** This comprehensive article reviews the practical developments and technological advancements in production during 1959, which have contributed to the solution of some of the many challenging problems facing the industry. Specific subjects discussed include: tubingless completions, new method for displacing multiple tubing string wells, abrasive jet perforating, perforations run on casing, sub-sea well completions, use of nitrogen in production operations, subsurface flowmeters, drill stem logging tools, new hydraulic fracturing technique, multizone pumping and many others.

These various developments will undoubtedly play an important role in reducing costs and increasing operating efficiency during the coming year. See Page 138.

from $3.01 in 1958 and a peak of $3.09 in 1957. In early 1960 the average was down further to $2.93. . . . Page 96

☐ **Drilling depth records set in five U.S. areas in 1959 . . .** There was no drilling below 20,000 feet to challenge the world record of 25,340 feet reached in West Texas in 1958. New regional records were set, however, in five areas. . . . . Page 101

☐ **U.S. drilling rig activity up 1.6 percent . . .** Rigs in operation averaged 4,178 during 1959, up only slightly from 4,114 in 1958. For seven years ending with 1957, active rigs averaged around 4,800. Highest recorded average was 4,950 in 1948, when one month had over 5,200. . . . . Page 103

☐ **Independents drill 78.8% of all U.S. wells . . .** Of the 48,328 new wells completed last year, 38,065 were drilled by independents. Larger companies drilled 10,263 wells or 21.2 percent of the U.S. total. . Page 105

☐ **Wildcat drilling to rise slightly in 1960 . . .** WORLD OIL estimates that 9,992 U.S. wildcats will be drilled in 1960, up 84 wells or 0.8% over the 9,908 drilled last year. . . . . Page 108

☐ **Artificial lift increase is predicted . . .** About 24,291 U.S. wells will be put on artificial lift in 1960, slightly more than in 1958. Most newly completed non-flowing wells will require new oil lifting equipment, though some will be equipped with items from abandoned wells. . . . . Page 114

☐ **More producing oil wells being operated . . .** U.S. producing oil wells totaled a record 589,533 at the end of 1959, up 15,018 from a year earlier. While 24,043 new oil wells were completed, 9,025 old wells were abandoned in 1959. Oil output per well averaged 12.1 barrels daily. . . . . Page 118

☐ **Ten U.S. areas set new producing depth records . . .** A South Louisiana well in 1959 retained the world record for deep production, though plugged back to 20,502 feet from 20,745. This was a second plug-back from the original producing depth of 21,465 feet in 1956. . . . . Page 116

☐ **Producing gas wells at new high and still increasing . . .** The number of U.S. producing gas and gas-condensate wells continued to increase and reached a new peak of 86,256 at the end of 1959. As about 5,000 new wells were completed in 1959 while 2,000 old wells were abandoned, there was a net gain of 3,000 . . . . . Page 120

☐ **U.S. geophysical activity at 13-year low . . .** Active geophysical crews decreased in 1959 to 431, fewest since 1946. Wyoming, Mississippi, New Mexico and Oklahoma showed gains; Texas Utah, Louisiana and Arkansas losses. . . . . Page 121

☐ **Free world drilling to expand 4.6 percent . . .** Moderate expansion of drilling outside the U.S. and Canada is expected in 1960. Mexico, Argentina, Libya, Algeria, Syria, Philippines, and Australia likely will record increases. Declines in Venezuela and Cuba will continue. . . . . Page 128

☐ **Canadian drilling expected to rise in 1960 . . .** Forecast: 3,025 wells and 13.6 million feet of hole. Excess productive capacity retards activity. But new pipe line outlets and certain "hot" exploration areas will boost drilling in some regions. . . . . Page 129

What's new in

Exploration?*

COORDINATION OF exploration data to increase effectiveness of geological and geophysical tools and methods is the major trend in today's exploration.

Typical of articles describing this trend was R. A. Broding's "How to Cross-Check Accuracy of Velocity and Seismic Data" in the November 1959 issue of WORLD OIL. This article discussed means of comparing seismic shock waves and sonic impulse velocities.

H. T. Brundage

This is but one example of WORLD OIL's long-standing policy to provide you, the reader, with the most accurate, complete and up-to-date technical information available to the industry —every month.

In addition, once a year WORLD OIL seeks out the most qualified exploration authorities to give you a complete round up of all the new developments that took place during the past year, and to give you a glimpse at the future. You will be reading the 11th edition of this timely, authoritative report in your April issue of WORLD OIL.

Leading off the Exploration Issue will be "Recent Trends in Exploration Methods" by two distinguished authors with The British Petroleum Limited and affiliates. Then, dealing more specifically with late developments will be articles covering such subjects as:

- . . . Magnetic orientation of sandstone cores.
- . . . Use of electronic computers in exploration.
- . . . Evaluation of cuttings from aerated water drilling.
- . . . The new science of palynology.
- . . . Inverse filtering of marine seismograms to eliminate the multiples problem.

To give you an example of how thoroughly WORLD OIL will cover these subjects, there will be two articles on geochemistry. "How to Make Geochemical Exploration Succeed" will describe the ways in which the geochemical approach has been made to work in the United States, Russia and elsewhere. The article will be authored by Dr. S. J. Pirson, a geologist and engineer of world-wide reputation. Also, Orton Campbell will tell "Why Sedimentary Structures Have High Self-Potentials". He also will analyze the merits of the electrical (telluric) approach to exploration.

So, you can see that WORLD OIL has left no stone unturned to obtain the latest, most informative round up on exploration developments to be published by any oil industry publication. All of this will be yours for the reading in WORLD OIL's April Exploration Issue.

Harrison T. Brundage

You will find the most complete, authoritative answer available to date in WORLD OIL's April Exploration Issue.

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WORLD OIL (formerly The Oil Weekly) and The COMPOSITE CATALOG for the drilling-producing industry.
PIPE LINE INDUSTRY and The PIPE LINE CATALOG for the oil and gas pipe line industry.
PETROLEUM REFINER and The REFINERY CATALOG for the oil, gas and petrochemical processing industry.

Indexed by Industrial Arts Index and Engineering Index

Looking Ahead

Trends and Developments to Watch in 1960

Editor's Note: In addition to the forecast-reviews on industry activity and economics published elsewhere in this issue, two other trends will play a major role in oil industry progress during the year. They include:

1. Increased efforts to cut costs, improve efficiency

Exploration . . . Educated guesses are that most of this country's undiscovered oil reserves are hidden in stratigraphic traps. Look for research to uncover improved methods and equipment that will more accurately identify new reservoirs.

Drilling . . . Major breakthroughs may be forthcoming in miniaturization of equipment for slim hole drilling, new instrumentation developments, ways to reach greater depths with less steel and labor.

Developments to watch: Instrument that permits continuous hole deviation readings is expected to be available on rental basis this year. Readings are taken by instrument in sub just above bit and sent to surface by pressure impulses in mud stream. Device can measure deviation from .02° to 10½°; pumps are shut down less than a minute for readings . . . **Vibratory fishing tool,** now in testing stage, which sets up vertical vibratory motion around stuck drill pipe, sanded-up tubing or cemented casing using off-center weights . . . **Another new method** now being tested employs torsional strain as well as vertical stress by using rotary table to turn the pipe.

Production . . . New secondary recovery methods, improvements in instrumentation and tubingless completions will move forward in 1960. Look for stepped up efforts to reduce steel and labor costs.

Developments to watch: A new nuclear radiation detector, small enough to fit on head of a pin. Because of its low cost, tiny size and improved efficiency, device is expected to increase effectiveness of flow measurement, viscosity gaging, liquid level measurement, oil well logging and tracing of isotope flows.

Also, look for long-term leasing of production equipment to double this year, after grossing $30.4 million last year, up 60 percent over 1958. Reasons: More equipment manufacturers will adopt leasing as another sales tool to move their products. More producers will turn to leasing as tight money conditions continue.

2. More active participation in government affairs

Watch for oil companies to become more embroiled than ever in government affairs. Trend toward active participation in politics will gain momentum. Reasons:

Depletion provision, natural gas bill, gasoline tax. Although some government leaders will try to make political hay at expense of depletion provision, little action is expected on these three critical issues during 1960. However, solid groundwork will be laid for big display of verbal fireworks in 1961.

Several industry groups will try to get action on new natural gas bill, but fears are that moves will be treated like red hot potato during 1960 presidential election year. New hike in gasoline tax also will be too hot to handle. But look out for 1961.

Coal and labor. Look for coal to intensify effort to force end-use controls on fuel oil and natural gas. Propaganda leaflets already have been widely distributed . . . **Labor's growing political strength** will force strong counteractive moves by industry management. Thus, more active political participation on local, state and federal levels can be expected.

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Stop talking – start acting

ON THE SURFACE it would appear that the oil industry is on its way toward a recovery year in 1960. According to WORLD OIL forecasts:

> . . . U.S. producers will need to increase their crude oil output 385,000 barrels daily or 5.5 percent over 1959 to meet an expected total demand for 7.4 million barrels daily.
>
> . . . To meet the growth in demand and continue to build up an adequate surplus of reserves for the future, operators are expected to complete 49,020 wells, up 1.4 percent over 1959.
>
> . . . In completing more wells, the industry will drill 206 million feet of hole, up 1.8 percent over 1959.

In short, each of the above categories is expected to show improvement over last year, which resulted in less wells and footage drilled than in 1958, which also was a year of depressed activity.

There is only one fallacy in making such predictions, optimistic or otherwise. No matter how accurate they may be—and WORLD OIL's have been up to 99 percent accurate over the years—forecasts can only mirror industry activity as a whole. What happens to the industry's economic position may be a completely different story.

Thus, during what should be a recovery year as far as activity is concerned, some corporations still will bring in below normal returns for their stockholders, some independent producers and drilling contractors will find the going tough until conditions improve. Perhaps too many. And chances are it will not be their fault entirely.

In fact, the Independent Producers Association of America paints a gloomy industry picture for the present—one that points to a year of possibly depressed economics amid increased activity. During a recent two-day executive committee meeting in Washington, D.C., the group took a close look at the industry's economic problems, and what can be done about them. This is what they found:

Recession amidst prosperity. The oil economy is out of tune with and lagging behind the general U.S. business climate.

Crude oil production has been depressed for prolonged periods. Oil prices have deteriorated while prices of commodities other than farm and food products have continued to climb.

The industry continues to be plagued with an imbalance of inventories of certain products, i.e., residuals. It has been beset with price wars at the marketing level, and price softness all the way back to the wellhead. In most sections, the industry itself absorbed the increase in the federal gasoline tax voted by Congress last year.

These conditions, at times, have served to aggravate differences and misunderstandings among different segments of the industry itself.

What is being done. The I.P.A.A. has authorized creation of a special industry committee which will study the whole broad range of factors that in any way contribute to present unhealthy conditions. They will include oil imports, oil prices, costs, conservation practices, well spacing problems, drilling rates and practices, oil and gas tax policy, natural gas regulation, competition between fuels, and other pertinent subjects.

The committee's purpose will be to recommend to the industry a program of corrective actions and set forth a blueprint of basic principles that all who seek a healthy industry can live by. It is the group's belief that only in this way can the industry put its house in order and plan its future activities with the same degree of confidence now so evident in other major U.S. industries.

Call to action. The proposed study is a big chunk for any oil industry group to bite into. The issues are complicated, far ranging and directly involve every segment of the nation—industry, government and the general public. The facts must be found, completely and accurately, on every detrimental economic factor. Solutions to the problems must carefully be determined and sold to those in whose hands the economic future of oil rests.

Such a project should not be dropped in the lap of one group. It is too enormous a task. It should be an all-industry effort. And the IPAA is welcoming suggestions and contributions from any individual or group concerned over present conditions and determined to correct them.

If such cooperation can be obtained, perhaps the industry can once again raise its economic position to at least match its activity.

MR. JAKE L. HAMON

President, Hamon Oil Company
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"Valued Partners . . ."

"My business is drilling for oil and gas. If the wells are successful, I must produce them efficiently and economically.

"I consult the service and supply men whenever drilling is started in a new territory. They quickly give me the correct information on the area, because they know the operating problems. This saves me valuable time and provides for a planned drilling program.

"We are continually faced with the problem of drilling and completing deeper and deeper wells. The research departments of the Equipment and Service Industries have developed new and better materials to get this job done. Without the improved equipment we would really be up the creek. The Supply Stores stock needed materials, eliminating burdensome and costly inventories for the operator.

"With the cooperation of the manufacturers, the American Petroleum Institute has done a great job in its standardization activities. Their men have served the committees faithfully, giving unselfishly of their time and knowledge. Because their plants and offices, in many cases, are located outside oil and gas producing states, they have assisted us in defending the depletion provision in those areas.

"Manufacturing, service and supply companies are valued partners to me. They are always 'Johnny-on-the-spot' with equipment, supplies and know-how, when and where it is needed. These companies are made up of loyal, determined, aggressive men who, through their dedication and willingness to sacrifice, are 'oil men' in the truest sense of the word."

P.E.S.A.*

* PETROLEUM EQUIPMENT SUPPLIERS ASSOCIATION

PROUD TO BE PART OF A PIONEERING INDUSTRY

PETROLEUM EQUIPMENT SUPPLIERS ASSOCIATION

The changing panorama, 1959-1960

BOTH THE PETROLEUM and natural gas industries expect to handle new record volumes of business in 1960, after having sold their products in 1959 at higher rates than ever before.

Both industries have been having some difficulties with their markets. Prices of petroleum products and crude oil have been depressed during the past two years, because of over-supplies. But henceforth they should stabilize and possibly begin to improve, with benefit of effective balancing of supply with demand and a currently satisfactory oil inventory situation.

Coupled with record setting volumes of business, even limited improvement of prices would greatly help oil companies to show more satisfactory earnings than they had in 1958 and 1959. Some betterment of results was achieved in 1959, but mainly through cost cutting and increased efficiency, as low prices persisted.

Natural gas. Although strictly regulated by governmental agencies, the natural gas industry has fared relatively better than the oil industry in regard to prices during the past few years. Prices of natural gas are

Tabular Summary of Forecasts for 1960 . . . and Results in 1959 vs. 1958 (Part 1)

Units for different items: thousand barrels daily, except as noted.

ITEM (Thousand barrels daily, except as noted)	Forecast 1960	% Diff. 1960-1959	1959	% Diff. 1959-1958	1958
Total Demand, thousand barrels daily	**10,080**	**+3.8**	**9,710**	**+3.8**	**9,358**
Gasoline	4,260	+3.1	4,130	+3.0	4,009
Kerosine	306	—0.6	308	—1.9	314
Distillate	1,945	+3.8	1,873	+1.7	1,842
Residual	1,647	+2.2	1,612	+5.6	1,526
Other Oils	1,922	+7.6	1,787	+7.2	1,667
Exports	**216**	**—1.4**	**219**	**—20.7**	**276**
Crude Oil	7	...	7	—41.7	12
Products	209	1.4	212	—19.7	264
Domestic Demand	**9,864**	**+3.9**	**9,491**	**+ 4.5**	**9,083**
Gasoline	4,214	+3.2	4,083	+ 3.8	3,934
Kerosine	304	—0.7	306	— 1.3	310
Distillate	1,907	+4.0	1,834	+ 2.5	1,790
Residual	1,587	+2.3	1,551	+ 6.6	1,455
Other Oils	1,852	+7.9	1,717	+ 7.7	1,594
Stock Change	**+23**	...	**—35**	...	**—140**
Crude Oil	...	...	—37	...	—52
Products	+23	...	+2	...	—88
New Supply	**10,103**	**+4.4**	**9,675**	**+ 5.0**	**9,218**
Imports	**1,799**	**+2.2**	**1,760**	**+ 3.5**	**1,700**
Crude Oil	975	+1.5	961	+ 0.8	953
Products	824	+3.1	799	+ 7.0	747
Production	**8,304**	**+4.9**	**7,915**	**+ 5.3**	**7,518**
Crude Oil	7,427	+5.4	7,045	+ 5.0	6,710
Value at Wells, $ Million	*7,965	+5.4	7,560	+ 2.4	7,380
Average Value, $ Barrel at Wells	*2.93	—0.3	2.94	— 2.3	3.01
Natural Gas Liquids	877	+0.8	870	+ 7.7	808
Value at Plant, $ Million	*755	+1.1	747	+ 8.3	690
Average Value, ¢ Gallon at Plants	*5.6	...	5.6	...	5.6
Runs to Stills	**8,356**	**+4.5**	**8,000**	**+ 4.7**	**7,642**
Domestic Crude	7,381	+4.9	7,039	+ 4.3	6,751
Foreign Crude	975	+1.5	961	+ 0.4	957
Nat'l Gas Gross Prod., Biln, Cu. Ft.	**14,100**	**+3.7**	**13,600**	**+ 3.4**	**13,147**
From Gas Wells	9,875	+3.9	9,500	+ 3.8	9,154
From Oil Wells	4,225	+3.0	4,100	+ 2.7	3,993
Nat'l Gas Marketed Prod. Biln. Cu. Ft.	**11,800**	**+3.5**	**11,400**	**+ 3.4**	**11,030**
Value, Consumption Pts., $ Million	*5,626	+5.1	5,355	+ 7.8	4,968
Cents per Thous. Cu. Ft.	*48.5	+1.5	47.8	+ 3.5	46.2
Value at Wells, $ Million	*1,440	+4.4	1,379	+ 4.7	1,317
Cents per Thous. Cu. Ft.	*12.2	+0.8	12.1	+ 1.7	11.9

* On basis of prices in January, 1960.

Continued on Page 26

being held through controls below the levels they seek economically, especially prices at the well.

But gas prices at all levels are continuing to show gradual, limited improvement. The price gains, in conjunction with increasing sales, are conducive to steady, profitable operations in the gas industry.

Many oil companies have important reserves and production of natural gas and natural gas liquids. Sales of those resources are adding increasingly to their revenue from crude oil and petroleum products.

Growth ahead. Both the oil industry and the natural gas industry will continue to grow and expand. Further expansion will be needed to meet the ever-increasing demand for oil and gas, as population grows and living standards rise.

As they advance, the oil and gas industries will continue to require materials, equipment, and services from suppliers of those items in vast amounts. And so a promising outlook for oil and gas companies also means good prospects for companies and people selling goods and services to them.

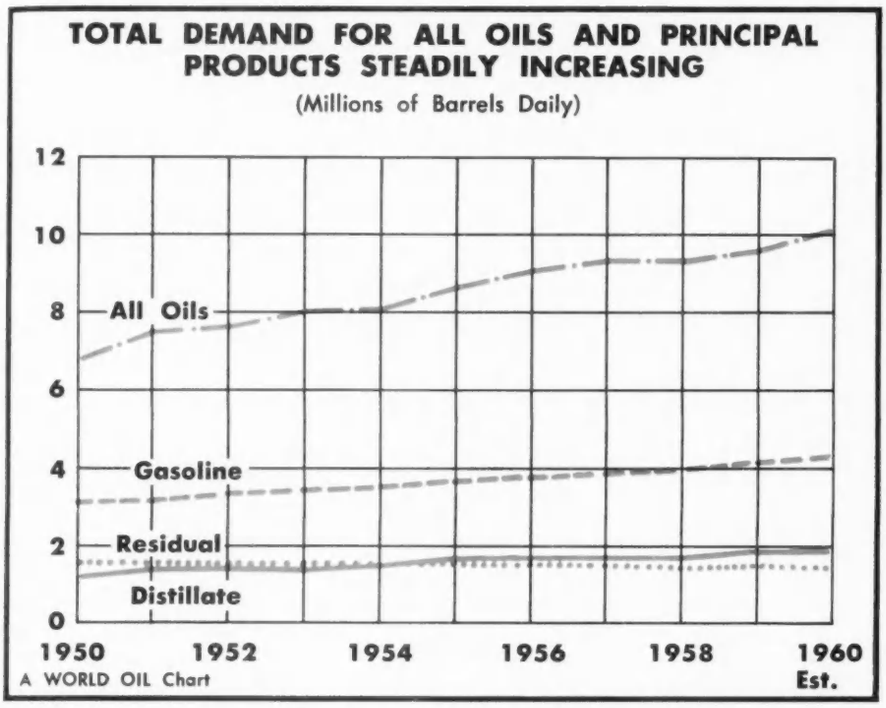
See tables. The tabular summaries herewith show concisely that oil and gas industry operations are expected to expand generally in 1960. In many cases, new all-time records will be set.

The tables also show that operations in 1959, likewise, were characteristically vigorous. Increases above 1958 levels occurred in oil and gas demand, production, and sales. Volumes of business broke previous records.

Tabular Summary of Forecasts for 1960 . . . and Results in 1959 vs. 1958 (Part 2)

Units for different items: number, except as noted.

ITEM (Number, except as noted)	Forecast 1960	% Diff. 1960—1959	1959	% Diff. 1959—1958	1958
Stocks, Year-End, thous. bbls.	**812,000**	**+1.0**	**803,600**	**+1.9**	**788,796**
(Days' Supply)	81	—2.4	83	—1.2	84
Crude Oil	253,600	.....	253,600	—3.5	262,730
(Days' Supply)	30	—6.7	32	—5.9	34
Natural Gas Liquids	27,000	.....	27,000	+18.7	22,752
Refined Products	531,400	+1.6	523,000	+3.9	503,314
Gasoline	.....	.....	189,000	+1.2	186,760
(Days' Supply)	.....	.....	46	—2.1	47
Distillate	.....	.....	148,800	+18.9	125,101
(Days' Supply)	.....	.....	79	+16.2	68
Kerosine	.....	.....	26,800	+2.9	26,040
(Days' Supply)	.....	.....	87	+4.8	83
Residual	.....	.....	49,900	—16.1	59,508
(Days' Supply)	.....	.....	31	—20.5	39
Other Products	.....	.....	108,500	+2.4	105,905
New Fields Discovered	.....	.....	**1,079**	**+2.9**	**1,049**
Oil	.....	.....	713	—4.0	743
Distillate	.....	.....	85	+6.2	80
Gas	.....	.....	281	+24.3	226
Wildcats Drilled	**9,992**	**+0.8**	**9,908**	**+1.1**	**9,799**
Productive	.....	.....	1,079	+2.9	1,049
Dry	.....	.....	8,829	+0.9	8,750
Wells Completed, Total	.....	.....	**48,809**	**—0.6**	**49,109**
New Wells Completed, Total	**49,020**	**+1.4**	**48,328**	**—0.7**	**48,670**
Oil Wells	24,045	.....	24,043	.....	24,048
Distillate Wells	5,041	+2.2	800	+12.7	710
Gas Wells			4,131	—4.7	4,332
Dry Holes	19,934	+3.0	18,589	+1.5	18,312
Input and Disposal Wells			765	—39.7	1,268
Old Wells Drilled Deeper	.....	.....	**481**	**+9.6**	**439**
Footage Drilled, thousand ft.	.....	.....	**203,038**	**+3.9**	**195,478**
Footage, New Wells	**206,162**	**+1.8**	**202,528**	**+3.8**	**195,084**
Development wells	.....	.....	195,933	+3.7	188,958
Wildcats	.....	.....	6,595	+7.7	6,126
Footage, Old Wells	.....	.....	**510**	**+29.1**	**394**
Wells Drilling, End of Year	.....	.....	**4,094**	**—7.9**	**4,445**
During Year, Average	.....	.....	4,178	+1.6	4,114
Producing Oil Wells, End of Year	.....	.....	**589,533**	**+2.6**	**574,515**
On Artificial Lift	.....	.....	520,919	+2.9	506,390
Flowing	.....	.....	68,614	+0.7	68,125
Producing Gas & Cond. Wells, Yr. End.	.....	.....	**86,256**	**+3.5**	**83,328**
Gas Wells	.....	.....	77,006	+2.8	74,894
Condensate Wells	.....	.....	9,250	+9.7	8,434



High crude output needed to supply record demand

More U. S. crude oil production than ever before will be required to meet the expected record demand for petroleum products in 1960.

The markets are expected to absorb domestic crude production averaging 7,427,000 barrels daily, an increase of 385,000 barrels or 5.5 percent over the 7,042,000 daily produced in 1959.

This outlook is indicated by the Bureau of Mines forecast of petroleum supply and demand in 1960. The above figures assume that crude stocks will not be increased or reduced; that product stocks will be enlarged by 8.4 million barrels (23,000 daily); that imports of crude and products will be increased about 39,000 barrels or 2.2 percent to 1,799,000 barrels daily; and that domestic production of natural gas liquids will be increased to 877,000 barrels daily from 870,000.

In its forecast the bureau estimated the required production of domestic crude in 1960 by quarters. (See table.) As compared with 1959, output will need to be increased by 302,000 barrels daily in the first quarter, 213,000 daily in the second quarter, 520,000 a day in the third quarter, and 490,000 per day in the fourth quarter. The increases will be larger in the third and fourth quarters because production was higher than necessary in the first half of 1959 but more moderate in the latter half.

U. S. crude production of 7,042,000 barrels daily in 1959 was an increase of 332,000 barrels or 5 percent over the curtailed output of 6,710,000 daily daily in 1958 and nearly as much as the record production of 7,170,000 daily in 1957.

Total demand for all oils will rise in 1960 to 10,080,000 barrels daily, an increase of 370,000 barrels or 3.8 percent over 1959, according to the forecast. This would be nearly the same gain as that in 1959, when demand of 9,710,000 barrels daily was an increase of 352,000 barrels or 3.8 percent.

It is expected that exports will further decline to 216,000 barrels daily in 1960 (only 2.1 percent of total demand), from 219,000 daily in 1959 and 276,000 in 1958. Crude oil exports have dwindled to 7,000 barrels per day. Exports of products, mainly special items, are down almost to 200,000 barrels daily.

Domestic demand is estimated at 9,864,000 barrels daily in 1960, an increase of 373,000 barrels or 3.9 percent over 1959. The domestic consumption of 9,491,000 barrels per day in 1959 was 408,000 barrels or 4.5 percent above depressed 1958.

Total demand for gasoline is forecast at 4,260,000 barrels daily in 1960, up 130,000 barrels or 3.1 percent over

U. S. Petroleum Supply and Demand

(Source: U. S. Bureau of Mines . . . Thousands of Barrels Daily.)

	SUPPLY				DEMAND		
YEAR	U.S. Prod. All Oils	Total Imports	Total New Supply	Change in Stocks All Oils	Domestic Demand	Exports and Shipments	Total Demand
1946.....	5,073	377	5,450	+119	4,912	419	5,331
1947.....	5,451	437	5,888	— 14	5,451	451	5,902
1948.....	5,921	514	6 435	+292	5,775	368	6,143
1949.....	5,477	645	6,122	— 8	5,803	327	6,130
1950.....	5,906	850	6,756	— 55	6,507	304	6,811
1951.....	6,720	844	7,564	+ 89	7,053	422	7,475
1952.....	6,868	952	7,820	+108	7,280	432	7.712
1953.....	7,113	1,034	8,147	+142	7,604	401	8,005
1954.....	7,035	1,052	8,087	— 29	7,760	355	8,115
1955.....	7,579	1,248	8,827	.....	8,459	368	8,827
1956.....	7,952	1,436	9,388	+179	8,779	430	9,209
1957.....	7,979	1,574	9,553	+167	8,818	568	9,386
1958.....	7,518	1,700	9,218	—140	9,083	276	9,358
1959.....	7,915	1,760	9,675	— 35	9,491	219	9,710
1960 Est.....	8,304	1,799	10,103	+ 23	9,864	216	10,080

Forecast of Supply and Demand for All Oils in the United States in 1960, Compared with 1959, by Years and by Quarters . . . Also Comparing Year 1959 with 1958.

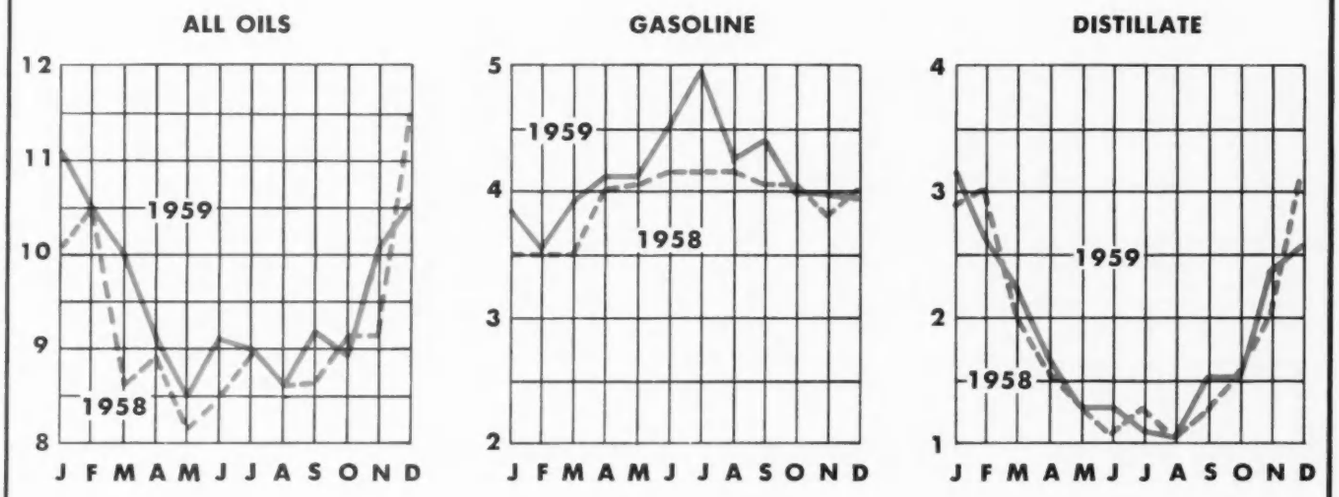
(Includes Alaska and Hawaii)

(Source: U. S. Bureau of Mines . . . Thousand Barrels Daily.)

ITEM	ANNUAL DATA					QUARTERLY DATA											
						1st Quarter			2nd Quarter			3rd Quarter			4th Quarter		
	1958 Actual	1959 Part Est.	% Diff. 1958-1959	1960 Forecast	% Diff. 1959-1960	1959	1960	% Diff.	1959	1960	% Diff.	1959	1960	% Diff.	1959	1960	% Diff.
Production	**7,518**	**7,915**	**5.3**	**8,304**	**4.9**	**8,081**	**8,414**	**4.1**	**8,052**	**8,245**	**2.4**	**7,657**	**8,172**	**6.7**	**7,875**	**8,385**	**6.5**
Crude Oil	6,710	7,045	5.0	7,427	5.4	7,202	7,504	4.2	7,187	7,400	5.0	6,801	7,321	7.6	6,994	7,484	7.0
Other Oils	808	870	7.7	877	0.8	879	910	3.5	865	845	—2.3	856	851	—0.6	881	901	2.3
Imports	**1,700**	**1,760**	**3.5**	**1,799**	**2.2**	**2,224**	**1,911**	**—14.1**	**1,598**	**1,741**	**8.9**	**1,534**	**1,704**	**11.1**	**1,694**	**1,840**	**8.6**
Crude Oil	953	961	0.8	975	1.5	958	980	2.3	962	975	1.4	945	960	1.6	980	985	0.5
Products	747	799	7.0	824	3.1	1,266	931	—26.5	636	766	20.4	589	744	26.3	714	855	19.7
New Supply	**9,218**	**9,675**	**5.0**	**10,103**	**4.4**	**10,305**	**10,325**	**0.2**	**9,650**	**9,986**	**3.5**	**9,191**	**9,876**	**7.5**	**9,569**	**10,225**	**6.9**
Stock Change	**—140**	**—35**	.....	**+23**	.....	**—339**	**—528**	.....	**+633**	**+586**	.....	**+174**	**+400**	.....	**—605**	**—368**	.....
Cude Oil	— 52	—37	.....	.....	.....	— 87	— 10	.....	+193	+106	.....	—234	— 90	.....	— 20	— 5	.....
Products	— 88	+ 2	.....	+23	.....	—252	—518	.....	+440	+480	.....	+408	+490	.....	—585	—363	.....
Total Demand	**9,358**	**9,710**	**3.8**	**10,080**	**3.8**	**10,644**	**10,853**	**2.0**	**9,017**	**9,400**	**4.2**	**9,017**	**9,476**	**5.1**	**10,174**	**10,593**	**4.1**
Gasoline	4,009	4,130	3.0	4,260	3.1	3,761	3,892	3.5	4,305	4,452	3.4	4,407	4,512	2.4	4,040	4,182	3.5
Kerosine	314	308	— 1.9	306	—0.6	466	467	0.2	161	162	0.6	202	192	—5.0	403	402	—0.2
Distillate	1,842	1,873	1.7	1,945	3.8	2,670	2,732	2.3	1,372	1,417	3.3	1,216	1,282	5.4	2,245	2,352	4.8
Residual	1,526	1,612	5.6	1,647	2.2	2,087	1,960	—6.1	1,432	1,517	5.9	1,242	1,378	11.0	1,697	1,735	2.2
All Other	1,667	1,787	7.2	1,922	7.6	1,660	1,802	8.6	1,747	1,852	6.0	1,950	2,112	8.3	1,789	1,922	7.4
Exports	**276**	**219**	**—20.7**	**216**	**—1.4**	**224**	**221**	**—1.3**	**225**	**216**	**—4.0**	**201**	**206**	**2.5**	**224**	**221**	**—1.3**
Crude Oil	12	7	—41.7	7	.....	7	7	.....	7	7	.....	6	7	16.7	7	7	.....
Products	264	212	—19.7	209	—1.4	217	214	—1.4	218	209	—4.1	195	199	2.1	217	214	—1.4
Domestic Demand	**9,083**	**9,491**	**4.5**	**9,864**	**3.9**	**10,420**	**10,632**	**2.0**	**8,792**	**9,184**	**4.5**	**8,816**	**9,270**	**5.1**	**9,950**	**10,372**	**4.2**
Gasoline	3,934	4,083	3.8	4,214	3.2	3,721	3,850	3.5	4,251	4,405	3.6	4,363	4,465	2.3	3,993	4,135	3.6
Kerosine	310	306	— 1.3	304	—0.7	464	465	0.2	160	160	.....	199	190	—4.5	401	400	—0.2
Distillate	1,790	1,834	2.5	1,907	4.0	2,632	2,692	2.3	1,338	1,382	3.3	1,179	1,247	5.8	2,200	2,312	5.1
Residual	1,455	1,551	6.6	1,587	2.3	2,008	1,890	—5.9	1,370	1,457	6.4	1,196	1,328	11.0	1,637	1,675	2.3
All Other	1,594	1,717	7.7	1,852	7.9	1,595	1,735	8.8	1,673	1,780	6.4	1,879	2,040	8.6	1,719	1,850	7.6
Runs to Stills	**7,642**	**8,000**	**4.7**	**8,356**	**4.5**	**8,190**	**8,450**	**3.2**	**7,916**	**8,225**	**3.9**	**7,948**	**8,320**	**4.7**	**7,950**	**8,430**	**6.0**

PETROLEUM DEMAND FLUCTUATES WIDELY BY SEASONS

(Domestic and Export Demand—Millions of Barrels Daily, by Months)



A WORLD OIL Chart

1959. The demand of 4,130,000 barrels per day in 1959 was an increase of 121,000 barrels or 3 percent over 1958.

Distillate fuel oil total demand is projected to 1,945,000 barrels daily in 1960, a gain of 72,000 barrels or 3.8 percent. In 1959 it averaged 1,873,000 barrels per day, up 31,000 barrels or 1.7 percent over 1958.

Residual fuel oil demand is estimated at 1,647,000 barrels daily in 1960, and that would be 35,000 barrels or 2.2 percent more than in the past year. The 1959 demand of 1,612,000 barrels a day was an increase of 86,000 barrels or 5.6 percent.

Kerosine demand has continued to decrease. It is expected to drop 306,000 barrels daily in 1960 from 308,000 in 1959 and 314,000 in 1958.

Total demand for all other oils will average 1,922,000 barrels daily in 1960, it is estimated. That would be an increase of 135,000 barrels or 7.6 percent. This demand in 1959 was 1,787,000 barrels daily, up 120,000 barrels or 7.2 percent over 1958. The other oils include natural gasoline, liquefied petroleum gas, jet fuel, lubricants, wax, coke, asphalt, road oil, and miscellaneous products.

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Demand for All Oils and Principal Products, by Years

Total, domestic, and export demand supplied by U. S. petroleum industry.
(Source: U. S. Bureau of Mines . . . Thousands of Barrels.)

All Oils

Year	Total Demand Annual	Total Demand Daily	Domestic Total	Domestic Daily	Exports Total	Exports Daily
1946	1,945,909	5,331	1,792,786	4,912	153,123	419
1947	2,154,280	5,902	1,989,803	5,451	164,477	451
1948	2,218,352	6,143	2,113,678	5,775	134,674	368
1949	2,237,626	6,130	2,118,250	5,803	119,376	327
1950	2,486,363	6,812	2,375,057	6,507	111,306	305
1951	2,728,465	7,475	2,574,413	7,053	154,052	422
1952	2,822,595	7,712	2,664,407	7,280	158,188	432
1953	2,921,912	8,005	2,775,321	7,604	146,591	401
1954	2,962,157	8,115	2,832,424	7,760	129,733	355
1955	3,221,963	8,827	3,087,775	8,459	134,188	368
1956	3,370,573	9,209	3,213,187	8,779	157,386	430
1957	3,425,806	9,386	3,218,619	8,818	207,187	568
1958	3,415,851	9,358	3,315,213	9,083	100,638	276
1959	3,544,150	9,710	3,464,215	9,491	79,935	219
1960 Est.	3,679,200	10,080	3,600,360	9,864	78,840	216

Gasoline

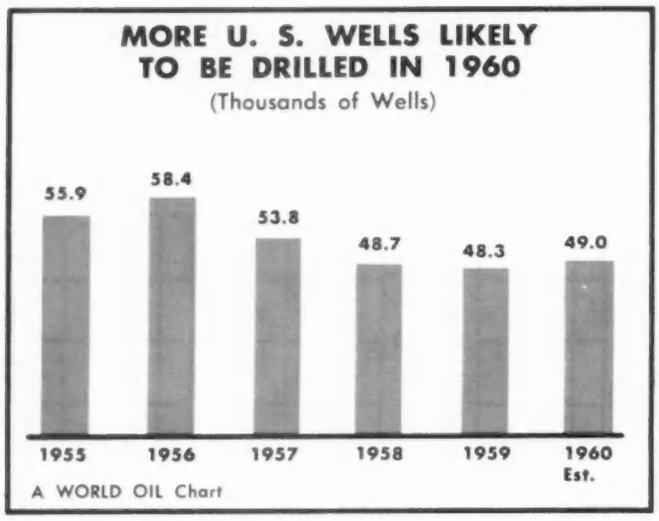
Year	Total Demand Annual	Total Demand Daily	Domestic Total	Domestic Daily	Exports Total	Exports Daily
1946	780,751	2,139	735,417	2,015	45,334	124
1947	842,464	2,308	795,015	2,178	47,449	130
1948	908,572	2,482	871,270	2,380	37,302	102
1949	953,060	2,611	913,713	2,503	39,347	108
1950	1,019,011	2,792	994,290	2,724	24,721	68
1951	1,132,087	3,102	1,091,951	2,992	40,136	110
1952	1,193,565	3,261	1,157,280	3,162	36,285	99
1953	1,243,700	3,407	1,205,775	3,303	37,925	104
1954	1,264,961	3,466	1,230,595	3,371	34,366	94
1955	1,368,726	3,750	1,334,205	3,655	34,521	95
1956	1,408,651	3,849	1,373,079	3,752	35,572	97
1957	1,431,541	3,922	1,392,953	3,816	38,588	106
1958	1,463,300	4,009	1,435,897	3,934	27,403	75
1959	1,507,450	4,130	1,490,295	4,083	17,155	47
1960 Est.	1,554,900	4,260	1,538,110	4,214	16,790	46

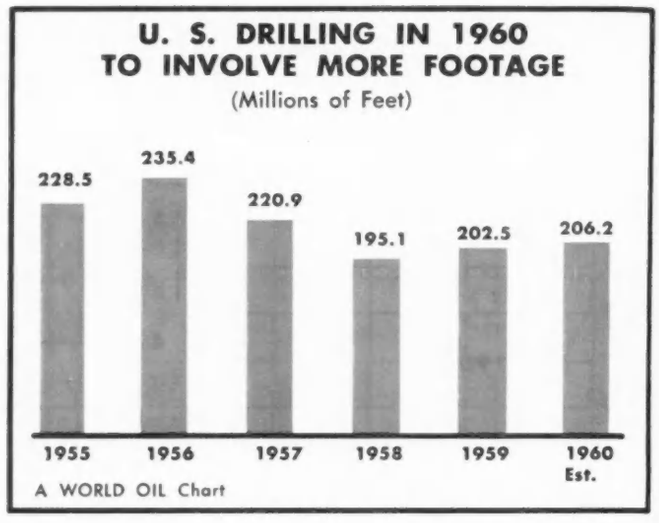
Distillate

Year	Total Demand Annual	Total Demand Daily	Domestic Total	Domestic Daily	Exports Total	Exports Daily
1946	272,381	746	242,894	665	29,487	81
1947	328,150	899	298,273	817	29,877	82
1948	361,869	989	340,576	930	21,293	58
1949	341,573	936	329,278	902	12,295	34
1950	407,538	1,117	394,885	1,082	12,653	35
1951	471,657	1,292	449,102	1,230	22,555	62
1952	512,862	1,405	479,347	1,310	33,515	92
1953	520,403	1,426	488,075	1,337	32,328	89
1954	550,570	1,508	526,347	1,442	24,223	66
1955	605,733	1,659	581,128	1,592	24,605	67
1956	650,391	1,777	615,856	1,682	34,535	95
1957	663,842	1,819	616,090	1,688	47,752	131
1958	672,368	1,842	653,426	1,790	18,942	52
1959	683,645	1,873	669,410	1,834	14,235	39
1960 Est.	709,925	1,945	696,055	1,907	13,870	38

Residual

Year	Total Demand Annual	Total Demand Daily	Domestic Total	Domestic Daily	Exports Total	Exports Daily
1946	489,217	1,340	480,029	1,315	9,188	25
1947	529,133	1,450	518,510	1,421	10,623	29
1948	513,554	1,403	500,543	1,368	13,011	35
1949	508,662	1,394	496,021	1,359	12,641	35
1950	570,021	1,562	553,793	1,517	16,228	44
1951	593,320	1,625	564,321	1,546	28,999	79
1952	582,866	1,593	555,165	1,517	27,701	76
1953	586,465	1,607	560,474	1,536	25,991	71
1954	549,070	1,504	522,317	1,431	26,753	73
1955	590,856	1,619	557,057	1,526	33,799	93
1956	590,690	1,614	562,813	1,538	27,877	76
1957	587,371	1,609	548,801	1,504	38,570	106
1958	556,810	1,526	531,067	1,455	25,743	71
1959	588,380	1,612	566,115	1,551	22,265	61
1960 Est.	601,155	1,647	579,255	1,587	21,900	60





Gain in U.S. drilling in 1960 forecast

WORLD OIL's annual drilling survey, conducted with the aid of information received from a large number of oil companies, forecasts the drilling of 49,020 new wells and 206.1 million feet of hole in the United States in 1960.

This would be 692 wells or 1.4 percent more than the 48,328 wells completed in 1959, and 3.6 million feet or 1.8 percent more than the 202.5 million feet drilled in 1959.

However, the increase would not restore drilling volume to the 1956 and 1957 levels. Totals of 53,783 wells and 220.8 million feet of hole were drilled in 1957. The peak drilling year occurred in 1956, when 58,418 wells and 235.4 million feet of hole were drilled.

More Crude Needed. Many of the difficulties which hampered U.S. oil industry operations during 1959 are expected to ease in 1960. General business activity is expected to improve considerably. A sizable increase in oil demand is anticipated. Larger demand for petroleum products will provide markets for more U.S. crude production, especially as imports of crude and products will be under strict control. If supplies of oils continue to be balanced closely with demand, as in the latter half of 1959, prices of products and of crude should henceforth be more stable and possibly begin to improve during the coming spring.

Record demand for U.S. crude will require larger volumes of production. This will mean more income for producers and will encourage an upturn in drilling activity. Expiration of leases in some of the more prospective areas, including regions in the Rocky Mountains, also will stimulate drilling.

The Bureau of Mines has estimated that the requirement for domestic crude oil production in 1960 will average 7,427,000 barrels daily, a new

Wells Completed Annually in United States

Source: WORLD OIL and predecessor, The Oil Weekly, with aid of other authoritative sources, 1921 to now; 1920 and earlier years from U.S. Bureau of Mines and "Petroleum in the United States and Possessions," by Arnold and Kemnitzer.

YEAR	Oil and Gas Tests				Service Wells			Total New Wells			Old Wells Drilled Deeper	Total Completions
	Oil	Distillate	Gas	Dry	Water Input	Gas Injection	Salt Water Disposal	New Wells Drilled	*Footage Drilled	*Avge. Well Depth		
1859-† 1940	750,064	.....	70,797	229,858	23,909	.....	.....	1,074,628	.....	.....	.....	1,074,628
1941	19,590	.....	3,279	7,280	2,197	117	47	32,510	99,347,714	3056	822	33,332
1942	10,977	105	2,685	5,962	2,141	73	47	21,990	76,903,053	3088	588	22,578
1943	9,887	76	2,314	6,364	1,576	90	42	20,349	61,991,857	3046	471	20,820
1944	13,502	54	3,024	7,153	1,784	218	51	25,786	84,378,457	3272	377	26,163
1945	13,944	153	3,039	7,346	1,796	329	42	26,649	92,982,113	3489	491	27,140
1946	16,087	207	3,355	8,496	1,816	219	50	30,230	101,124,813	3345	615	30,845
1947	17,613	283	3,437	9,751	1,861	156	46	33,147	112,816,124	3404	651	33,798
1948	22,197	346	2,966	11,939	1,885	84	60	39,477	136,709,153	3463	533	40,010
1949	21,415	378	3,121	12,898	1,036	56	58	38,962	138,616,941	3558	535	39,497
1950	23,775	465	3,015	14,918	993	38	103	43,307	159,761,732	3689	751	44,058
1951	23,532	344	3,198	17,497	1,323	35	67	45,996	176,757,221	3843	770	46,766
1952	23,371	348	3,345	18,211	1,147	25	62	46,509	188,392,695	4051	537	47,046
1953	25,251	374	3,858	18,759	1,123	25	90	49,480	198,431,603	4010	486	49,966
1954	28,063	672	3,547	19,137	682	21	75	52,197	211,296,158	4048	498	52,695
1955	30,474	709	3,460	20,564	551	13	108	55,879	228,529,688	4090	535	56,414
1956	30,641	551	3,944	22,254	852	10	166	58,418	235,386,441	4029	476	58,894
1957	27,519	743	3,879	20,250	1,281	7	104	53,783	220,863,576	4107	390	54,173
1958	24,048	710	4,332	18,312	1,126	5	137	48,670	195,083,688	4008	439	49,109
1959‡	24,043	800	4,131	18,589	659	12	94	48,328	202,528,285	4191	481	48,809
Total	1,155,993	7,318	134,726	495,538	49,738	1,533	1,449	1,846,295	.....	.....	10,446	1,856,741

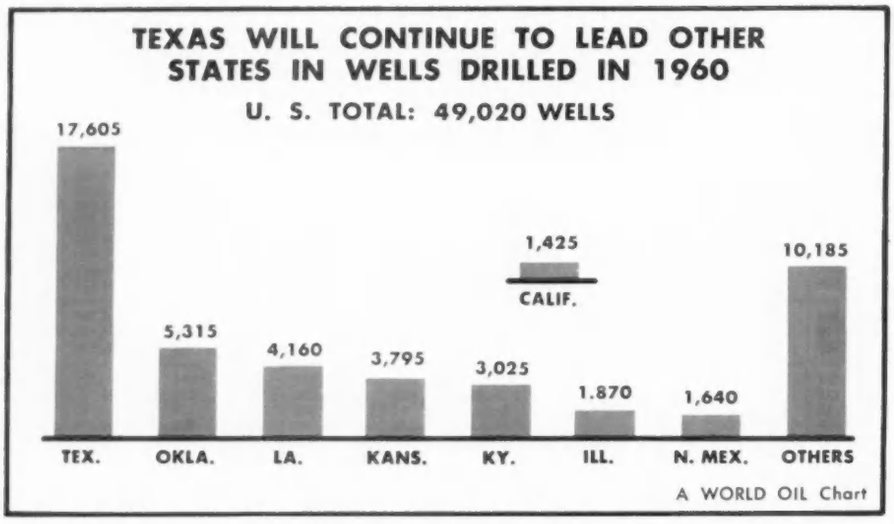
* Footage data not available prior to 1925 and estimated 1925-1930; actual statistics after 1930. † For annual data, 1918-1940, see WORLD OIL, Feb. 15, 1959, page 93. ‡ Data for 1959 subject to slight revision.

Footage and Average Depths Drilled in All Wells in the United States in 1959

STATE or DISTRICT	TOTAL NEW WELLS (See Below) 1959 Wells	1959 Footage	1959 Avge. Depth	1958 Wells	1958 Footage	1958 Avge. Depth	OLD WELLS DRILLED DEEPER, 1959 (Productive and Dry) Wells	Footage	Avge. Depth	TOTAL ALL WELLS 1959 Wells	1959 Footage	1959 Avge. Depth	1958 Wells	1958 Footage	1958 Avge. Depth
Alabama	108	976,926	9046	85	686,232	8073				108	976,926	9046	85	686,232	8073
Alaska	14	141,670	10119							14	141,670	10119			
Arkansas	814	2,728,131	3352	852	2,848,849	3344	3	1,916	639	817	2,730,047	3342	852	2,848,849	3344
California	1,487	7,123,633	4791	1,432	6,849,366	4783	140	182,218	1302	1,627	7,305,851	4490	1,534	6,942,410	4526
Colorado	726	3,818,603	5260	850	4,412,384	5191	3	2,765	922	729	3,821,368	5242	852	4,413,195	5180
Illinois	2,032	4,496,314	2213	2,302	5,273,689	2291	1	933	933	2,033	4,497,247	2212	2,302	5,273,689	2291
Indiana	847	1,282,957	1515	891	1,435,650	1611	6	2,348	391	853	1,285,305	1507	894	1,436,855	1607
Kansas	3,831	14,015,311	3658	3,759	12,981,318	3453	3	2,073	691	3,834	14,017,384	3656	3,760	12,981,423	3452
Kentucky	2,930	2,646,843	903	2,371	2,454,401	1035				2,930	2,646,843	903	2371	2,454,401	1035
Louisiana	3,831	29,289,485	7645	3,508	27,066,565	7716	10	22,336	2234	3,841	29,311,821	7631	3,510	27,070,877	7713
North Louisiana	1,543	5,445,656	3529	1,389	5,171,217	3723	4	7,138	1785	1,547	5,452,794	3525	1,390	5,172,760	3721
South Louisiana	2,288	23,843,829	10421	2,119	21,895,348	10333	6	15,198	2533	2,294	23,859,027	10401	2,120	21,898,118	10329
*Gulf of Mexico	474	4,867,623	10269	487	4,702,522	9656	1	600	600	475	4,868,223	10249	487	4,702,522	9656
Michigan	596	1,866,492	3132	392	1,123,455	2866	1	502	502	597	1,866,994	3127	394	1,125,126	2856
Mississippi	669	6,291,843	9405	428	3,641,127	8507	7	10,033	1433	676	6,301,876	9322	428	3,641,127	8507
Missouri	14	12,901	922	16	16,167	1010				14	12,901	922	16	16,167	1010
Montana	342	1,639,710	4794	306	1,607,096	5252	3	2,343	781	345	1,642,053	4760	308	1,608,809	5223
Nebraska	825	4,872,812	5906	697	4,163,621	5974				825	4,872,812	5906	697	4,163,621	5974
New Mexico	1,819	7,580,624	4167	1,970	9,107,964	4623	10	11,695	1170	1,829	7,592,319	4151	1,979	9,116,729	4607
Southeast	1,015	4,691,142	4622	969	4,835,379	4990	10	11,695	1170	1,025	4,702,837	4588	974	4,838,229	4967
Northwest	804	2,889,482	3594	1,001	4,272,585	4268				804	2,889,482	3594	1,005	4,278,500	4257
New York	278	481,275	1731	245	387,229	1581				278	481,275	1731	245	387,229	1581
North Dakota	433	2,741,670	6332	408	2,642,398	6476	2	2,276	1138	435	2,743,946	6308	410	2,647,977	6458
Ohio	1,085	2,761,713	2545	988	2,582,097	2613	15	5,868	391	1,100	2,767,581	2516	998	2,587,972	2593
Oklahoma	5,192	19,137,906	3686	7,047	21,963,621	3117	91	65,257	717	5,283	19,203,163	3635	7,159	22,059,744	3081
Pennsylvania	695	2,148,815	3092	794	2,407,178	3032	17	19,879	1169	712	2,168,694	3046	826	2,425,993	2937
South Dakota	23	168,360	7320	7	33,649	4807				23	168,360	7320	7	33,649	4807
Tennessee	107	100,422	939	30	37,650	1255				107	100,422	939	30	37,650	1255
Texas	17,597	77,636,405	4412	17,283	73,280,859	4240	107	111,265	1040	17,704	77,747,670	4392	17,412	73,412,142	4216
Dist. 1: South Central	979	2,587,789	2643	988	2,451,870	2482	3	2,818	939	982	2,590,607	2638	989	2,452,143	2479
Dist. 2: Middle Gulf	786	4,910,719	6248	699	4,280,900	6124	4	11,864	2966	790	4,922,583	6231	702	4,286,163	6106
Dist. 3: Upper Gulf	1,190	8,439,430	7092	1,295	8,366,026	6460	1	2,300	2300	1,191	8,441,730	7088	1,300	8,390,852	6455
*Gulf of Mexico	5	49,112	9822	11	86,748	7886				5	49,112	9822	11	86,748	7886
Dist. 4: Lower Gulf-S.W.	1,308	7,115,371	5440	1,128	5,861,401	5196	8	13,378	1672	1,316	7,128,749	5417	1,136	5,872,788	5170
*Gulf of Mexico	1	500	500	8	84,048	10506				1	500	500	8	84,048	10506
Dist. 5 & 6: East	1,002	5,502,923	5492	1,033	5,238,555	5071	1	306	306	1,003	5,503,229	5487	1,033	5,238,555	5071
Dist. 7-B & 9: North	5,889	17,372,645	2950	5,874	17,323,609	2949	29	33,783	1165	5,918	17,406,428	2941	5,923	17,364,499	2932
Dist. 7-C & 8: West	5,194	26,017,305	5009	4,960	24,089,168	4857	57	42,106	739	5,251	26,059,411	4963	5,022	24,135,321	4806
Dist. 10: Panhandle	1,249	5,690,223	4556	1,306	5,669,330	4341	4	4,710	1178	1,253	5,694,933	4834	1,307	5,671,821	4340
Utah	291	1,623,988	5581	395	2,189,909	5544	1	5,896	5896	292	1,629,884	5582	396	2,190,823	5532
Washington	4	31,928	7982	7	40,635	5805	1	812	812	5	32,740	6548	7	40,635	5805
West Virginia	783	2,009,755	2567	836	2,239,102	2678	38	34,626	911	821	2,044,381	2490	853	2,251,069	2639
Wyoming	898	4,687,227	5220	711	3,326,345	4678	22	24,976	1135	920	4,712,203	5122	724	3,338,495	4611
†Others	57	214,566	3764	60	299,110	4985				57	214,566	3764	60	299,110	4985
Total United States	48,328	202,528,285	4191	48,670	195,083,688	4008	481	510,017	1060	48,809	203,038,302	4160	49,109	195,478,320	3980

STATE or DISTRICT	OIL Wells	OIL Footage	OIL Avge. Depth	DISTILLATE Wells	DISTILLATE Footage	DISTILLATE Avge. Depth	GAS Wells	GAS Footage	GAS Avge. Depth	DRY Wells	DRY Footage	DRY Avge. Depth	SERVICE WELLS Wells	SERVICE WELLS Footage	SERVICE WELLS Avge. Depth
Alabama	75	834,578	11128												
Alaska	4	48,110	12028				3	25,867	8622	7	67,693	9670			
Arkansas	448	1,310,041	2924				44	212,196	4823	320	1,202,494	3758	2	3,400	1700
California	859	3,851,096	4483				82	385,565	4702	503	2,715,656	5399	43	171,316	3984
Colorado	138	717,750	5201	1	5,983	5983	76	442,195	5818	511	2,652,675	5191			
Illinois	963	2,279,399	2367				18	15,687	872	1,051	2,201,228	2094			
Indiana	280	426,958	1525				11	11,821	1075	547	829,146	1516	9	15,032	1670
Kansas	1,664	5,830,734	3504				187	842,008	4503	1,934	7,196,233	3721	46	146,336	3181
Kentucky	1,565	1,136,264	726				272	403,261	1483	1,066	1,073,756	1007	27	33,562	1243
Louisiana	1,805	11,821,131	6549	250	3,098,511	12394	286	2,205,088	7710	1,487	12,136,196	8162	3	28,559	9520
North Louisiana	772	2,053,204	2660	4	39,452	9863	158	690,043	4367	609	2,662,957	4373			
South Louisiana	1,033	9,767,927	9456	246	3,059,059	12435	128	1,515,045	11836	878	9,473,239	10790	3	28,559	9520
*Gulf of Mexico	288	2,768,415	9613	41	500,659	12211	20	220,435	11022	125	1,378,114	11025			
Michigan	239	737,316	3085				70	197,042	2815	287	932,134	331			
Mississippi	257	2,613,940	10171	13	115,938	8918	29	255,914	8825	370	3,306,051				
Missouri	1	380	380				13	12,521	963						
Montana	151	774,862	5132				9	22,665	2518	180	839,738	4665	2	2,445	1223
Nebraska	268	1,608,968	6004				1	5,225	5225	555	3,252,344	5860	1	6,275	6275
New Mexico	1,096	4,436,905	4048	1	6,257	6257	327	1,506,861	4608	388	1,607,830	4144	7	22,771	3253
Southeast	729	3,326,506	4563				28	141,027	5036	255	1,212,811	4756	3	10,798	3599
Northwest	367	1,110,399	3026	1	6,257	6257	299	1,365,834	4568	133	395,019	2970	4	11,973	2993
New York	145	186,325	1285				20	55,900	2795	38	141,550	3725	75	97,500	1300
North Dakota	259	1,742,343	6727							166	937,910	5650	8	61,417	7677
Ohio	498	1,354,422	2720				292	742,031	2541	293	664,079	2266	2	1,181	591
Oklahoma	2,619	9,192,138	3510	81	626,901	7740	447	2,359,414	5278	1,928	6,701,120	3476	117	258,333	2208
Pennsylvania	195	350,872	1799				315	1,283,978	4076	80	302,334	3779	105	211,631	2016
South Dakota	11	94,126	8557							12	74,234	6186			
Tennessee	5	4,925	985				1	1,300	1300	101	94,197	933			
Texas	9,816	40,219,132	4097	453	4,034,200	8906	1,058	5,898,856	5575	5,966	26,752,978	4484	304	731,239	2405
Dist. 1: South Central	528	1,037,600	1965	14	136,111	9722	29	148,960	5137	407	1,264,714	3107	1	404	404
Dist. 2: Middle Gulf	207	1,184,065	5720	112	936,886	8365	110	577,092	5246	357	2,212,676	6198			
Dist. 3: Upper Gulf	497	2,802,291	5638	149	1,567,617	10521	73	612,592	8392	471	3,456,930	7340			
*Gulf of Mexico	1	9,928	9928				1	11,005	11005	3	28,179	9393			
Dist. 4: Lower Gulf-S.W.	413	1,954,746	4733	166	1,312,207	7905	160	816,212	5101	563	3,000,579	5330	6	31,627	5271
*Gulf of Mexico										1	500	500			
Dist. 5 & 6: East	497	2,538,089	5107	5	34,228	6846	108	710,462	6578	395	2,216,494	5611	1	3,650	3650
Dist. 7-B & 9: North	3,026	8,381,608	2770	2	4,901	2451	217	1,027,894	4737	2,492	7,557,636	3033	182	400,706	2202
Dist. 7-C & 8: West	3,906	19,194,173	4914				120	880,963	7341	1,058	5,657,910	5348	110	284,259	2584
Dist. 10: Panhandle	742	3,126,560	4214	5	42,250	8450	245	1,124,781	4591	253	1,386,039	5478	4	10,593	2648
Utah	162	927,710	5727				18	78,625	4368	110	612,108	5565	1	5,545	5545
Washington										4	31,928	7982			
West Virginia	147	307,821	2094				502	1,343,767	2677	131	338,661	2585	3	19,506	6502
Wyoming	369	1,784,110	4835	1	3,604	3604	60	402,449	6707	458	2,477,904	5410	10	19,160	1916
†Other States	4	18,148	4537				3	17,536	5845	50	178,882	3578			
Total United States	24,043	94,610,504	3935	800	7,891,394	9864	4,131	18,715,251	4530	18,589	79,475,928	4275	765	2,835,208	3706

* Gulf of Mexico wells are included in their respective districts. † Other states include: Arizona, Idaho, Oregon, South Carolina.



Forecast of New Wells and Footage to Be Drilled in 1960

Includes new wells drilled for oil or gas, salt-water disposal wells, water input wells, and gas-input wells. Does not include old wells drilled deeper.

State or District	Total New Wells			Footage (New Wells)		
	1960 Forecast	1959 Actual	% Diff.	1960 Forecast	1959 Actual	% Diff.
Alabama	85	108	—21	772,000	976,926	— 21
Alaska	15	14	+ 7	143,000	141,670	+ 1
Arizona	40	36	+11	104,000	94,329	+ 10
Arkansas	925	814	+14	3,117,000	2,728,131	+ 14
California	1,425	1,487	— 4	6,840,000	7,123,633	— 4
Colorado	810	726	+12	4,250,000	3,818,603	+ 11
Illinois	1,870	2,032	— 8	4,114,000	4,496,314	— 9
Indiana	835	847	— 1	1,335,000	1,282,957	+ 4
Kansas	3,795	3,831	— 1	13,352,000	14,015,311	— 5
Kentucky	3,025	2,930	+ 3	2,723,000	2,646,843	+ 3
Louisiana	4,160	3,831	+ 9	31,710,000	29,289,485	+ 8
North Louisiana	1,710	1,543	+11	5,985,000	5,445,656	+ 10
South Louisiana	2,450	2,288	+ 7	25,725,000	23,843,829	+ 8
*Gulf of Mexico	590	474	+25	6,077,000	4,867,623	+ 25
Michigan	820	596	+38	2,542,000	1,866,492	+ 36
Mississippi	655	669	— 2	6,222,000	6,291,843	— 1
Missouri	15	14	+ 7	14,000	12,901	+ 9
Montana	440	342	+29	2,112,000	1,639,710	+ 29
Nebraska	785	825	— 5	4,631,000	4,872,812	— 5
New Mexico	1,640	1,819	—10	6,999,000	7,580,624	— 8
Southeast N. M.	930	1,015	— 8	4,301,000	4,691,142	— 8
Northwest N. M.	710	804	—12	2,698,000	2,889,482	— 7
New York	280	278	+ 1	462,000	481,275	— 4
North Dakota	375	433	—13	2,438,000	2,741,670	— 11
Ohio	1,050	1,085	— 3	2,625,000	2,761,713	— 5
Oklahoma	5,315	5,192	+ 2	20,197,000	19,137,906	+ 6
Pennsylvania	740	695	+ 7	2,220,000	2,148,815	+ 3
South Dakota	45	23	+96	360,000	168,360	+114
Tennessee	200	107	+87	170,000	100,422	+ 69
Texas	17,605	17,597	....	78,073,000	77,636,405	+ 1
Dist. 1: S. Central	1,150	979	+18	3,048,000	2,587,789	+ 18
Dist. 2: Middle Gulf	825	786	+ 5	5,198,000	4,910,719	+ 6
Dist. 3: Upper Gulf	1,315	1,190	+11	9,205,000	8,439,430	+ 19
Dist. 4: L. Gulf-S.W.	1,330	1,308	+ 2	7,050,000	7,115,371	— 1
Dist. 5 & 6: East	1,280	1,002	+28	6,912,000	5,502,923	+ 26
Dist. 7-B & 9: North	5,600	5,889	— 5	16,800,000	17,372,645	— 3
Dist. 7-C & 8: West	4,775	5,194	— 8	23,875,000	26,017,305	— 8
Dist 10: Panhandle	1,330	1,249	+ 7	5,985,000	5,690,223	+ 5
Utah	260	291	—11	1,443,000	1,623,988	— 11
West Virginia	835	783	+ 7	2,141,000	2,009,755	+ 7
Wyoming	950	898	+ 6	4,940,000	4,687,227	+ 5
†Other States	25	25	....	113,000	152,165	— 26
Total U.S.	49,020	48,328	+ 1	206,162,000	202,528,285	+ 2

* Included in South Louisiana. † Includes Florida, Georgia, Idaho, Maryland, Nevada, North Carolina, Oregon, Virginia, and Washington.

high and more than in 1959 by 382,000 barrels daily or 5.4 percent. (See Pages 81 and 90.)

Unfavorable factors. On the other hand, several existing factors will tend to restrict drilling gains to modest levels. Among unfavorable influences are anticipated tighter credit, higher interest rates, advances in costs without compensating price gains, and growing efforts to utilize wide U.S. well spacing programs.

Drilling increases are expected in most states. Of the nine states in the 1,000-plus well category, four are predicted to reflect increased drilling this year, and decreased activity is forecast for the remaining five.

The largest increase percentagewise is forecast for Louisiana. The 1960 prediction for Louisiana is 4,160 wells —up 8.6 percent—and 31.7 million feet of hole, a gain of 329 wells and 2.4 million feet.

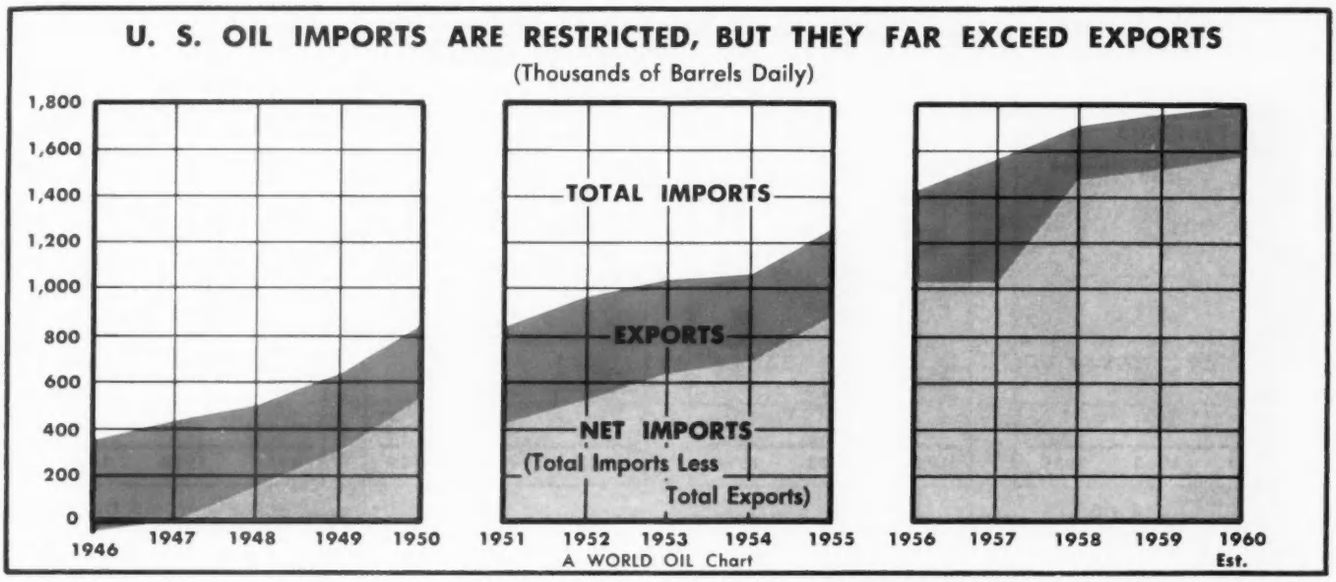
Texas, which in 1960 is expected to drill 17,605 new wells or 35.9 percent of the total for the United States, would account for only 8 wells more than the 17,597 drilled in 1959. Footage of slightly more than 78 million feet would be slightly more than the previous year's 77.6 million feet.

A 3.2 percent boost in drilling is predicted for Kentucky. A total of 3,025 wells will be drilled, compared with 2,930 in 1959. Footage is expected to increase to 2.7 million feet from about 2.6 million in 1959.

Oklahoma, with a forecast of 5,315 wells to be drilled in 1960, will record an increase of 2.4 percent from the 5,192 wells drilled in 1959.

Accurate forecasts of 1959 drilling activity were made by World Oil in its annual forecast, prepared in January, and in its midyear forecast, prepared in July. In July, 1959, World Oil predicted the drilling of 49,930 wells and 208,258,700 feet of hole for the year. Actual drilling totaled 48,328 wells, resulting in the forecast being 96.7 percent accurate. Footage drilled totaled 202,528,285 feet—which resulted in the footage forecast being 97.2 percent accurate.

World Oil's January forecast of 1959 drilling activity predicted the drilling of 50,275 wells during 1959, which was 96 percent accurate, and an accompanying footage of 203,009,000 feet of hole, which was 99.8 percent accurate.



Imports to increase while exports decline

THE UNITED STATES again in 1960, as in almost all other post-war years, will continue to increase its dependence on petroleum from other countries. Exports are expected to dwindle further, while imports will continue to increase.

The country was a net exporter of petroleum in 1946 and 1947, with exports slightly exceeding imports. But in 1948 imports exceeded exports by 147,000 barrels daily. Subsequently, net imports have steadily and sharply increased. In 1959, the nation imported 1,515,000 barrels a day more than it exported, after showing net imports of 1,424,000 daily in 1958. In 1960, net imports are expected to reach a new high of 1,583,000 barrels per day.

Imports of all oils are estimated by the Bureau of Mines at 1,799,000 barrels daily in 1960, an increase of 41,000 barrels or 2.3 percent over the 1,758,000 daily of 1959. In 1958, total imports averaged 1,700,000 daily. These increases are more gradual than those of previous years. They reflect the voluntary controls on imports in 1958, and the mandatory controls started in the spring of 1959 and still in effect.

Imports of crude oil are estimated at 975,000 barrels daily in 1960, compared with 956,000 in 1959, and 953,000 in 1958. Imports of refined products are forecast at 824,000 barrels per day in 1960, against 802,000 in 1959, and 747,000 in 1958.

It is expected that crude oil imports from Canada will be increased in 1960, as that country has large excess producing capacity, and restrictions on imports of Canadian crude have been eased.

U.S. crude oil exports are expected to average only about 7,000 barrels daily in 1960, the same as in 1959. They averaged 12,000 in 1958. Exports of refined products are estimated at 209,000 barrels daily in 1960, compared with 236,000 in 1959 and 264,000 in 1958.

U.S. oil exports are principally specialty products. About 35,000 barrels per day of aviation gasoline is being exported. Specialty lubricating oils also are important exports.

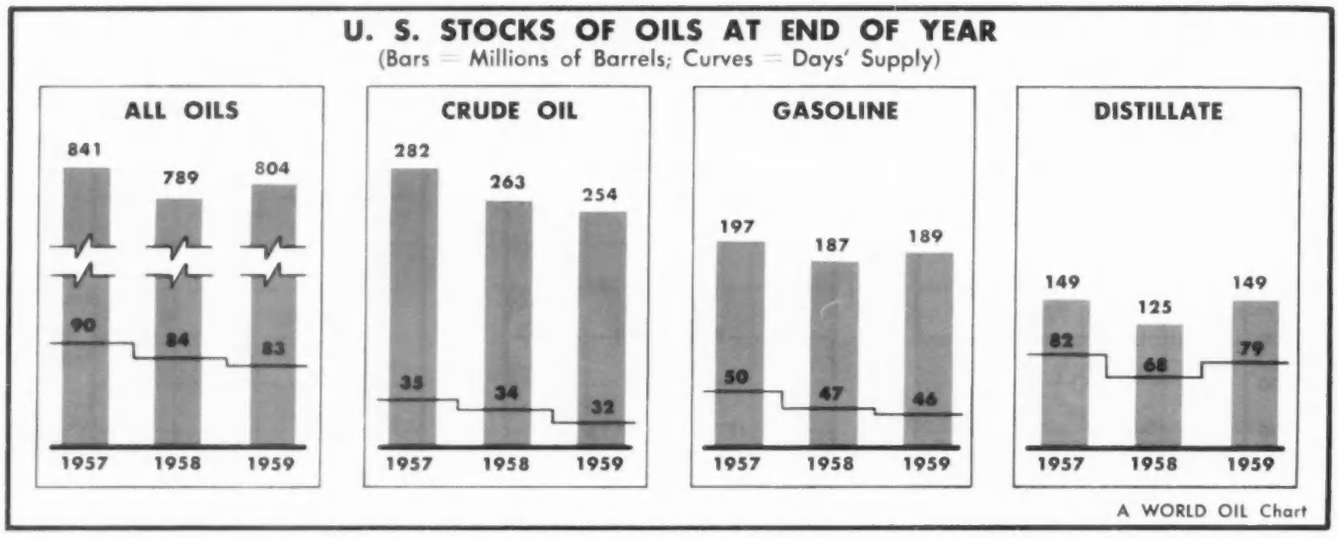
Excess of U.S. Oil Imports Over Exports, by Years

(Source: Bureau of Mines)

(Thousands of Barrels Per Day)

Year	IMPORTS			EXPORTS			NET IMPORTS		
	Crude Oil	Products	Total	Crude Oil	Products	Total	Crude Oil	Products	Total
1946..	236	141	**377**	116	303	**419**	120	162*	**42***
1947..	267	169	**437**	127	325	**451**	140	155*	**14***
1948..	353	161	**514**	108	259	**367**	245	98*	**147**
1949..	421	224	**645**	91	236	**327**	330	12*	**318**
1950..	487	363	**850**	95	210	**305**	392	153	**545**
1951..	491	354	**844**	78	344	**422**	413	10	**422**
1952..	573	379	**952**	73	359	**432**	500	20	**520**
1953..	648	386	**1,034**	55	347	**402**	593	39	**632**
1954..	656	396	**1,052**	37	319	**356**	619	77	**696**
1955..	782	466	**1,248**	32	336	**368**	750	130	**880**
1956..	934	502	**1,436**	78	352	**430**	856	150	**1,006**
1957..	1,023	552	**1,574**	138	430	**568**	885	122	**1,006**
1958..	953	747	**1,700**	12	264	**276**	941	483	**1,424**
1959..	956	802	**1,758**	7	236	**243**	949	566	**1,515**
1960†.	975	824	**1,799**	7	209	**216**	968	615	**1,583**

* Net Exports. † Estimate.



Stocks situation improves slightly

CONSIDERABLE EFFORT was made during the last six months of 1959 to correct the excessive inventories that accrued during the first half of the year. As a result, there was a decrease from 84 days' supply of all oils on hand at the start of the year to 83 days at the end.

Stocks of all oils totaled 803.6 million barrels on January 1, thus starting the new year with 14.8 million barrels, or 1.9 percent more in storage than at the start of 1959. This was considerably better than at mid-year, 1959, when stocks were 32 million barrels over the same 1958 period.

Actually, a substantial amount of crude was removed from storage during the year, while gasoline stocks held almost steady. The big increase was in distillate, with 23.7 million barrels added to inventories during the year, increasing the days' supply from 68 at the start of the year to 79 days 12 months later.

The U.S. Bureau of Mines assumes that no crude oil will be added to, or taken from, storage during 1960, and that stocks of all oils will increase 8.4 million barrels, or 1 percent, to a total of 812 million at the end of the year. This would further decrease the days' supply of stocks on hand to 81, as demand is expected to increase considerably.

Crude and gasoline. At the beginning of 1959, crude stocks totaled 262.7 million barrels. Twelve months later the total had been reduced 9.3 million barrels, or 3.5 percent to 253.6 million barrels. Also, the day's supply decreased from 34 to 32 during the year.

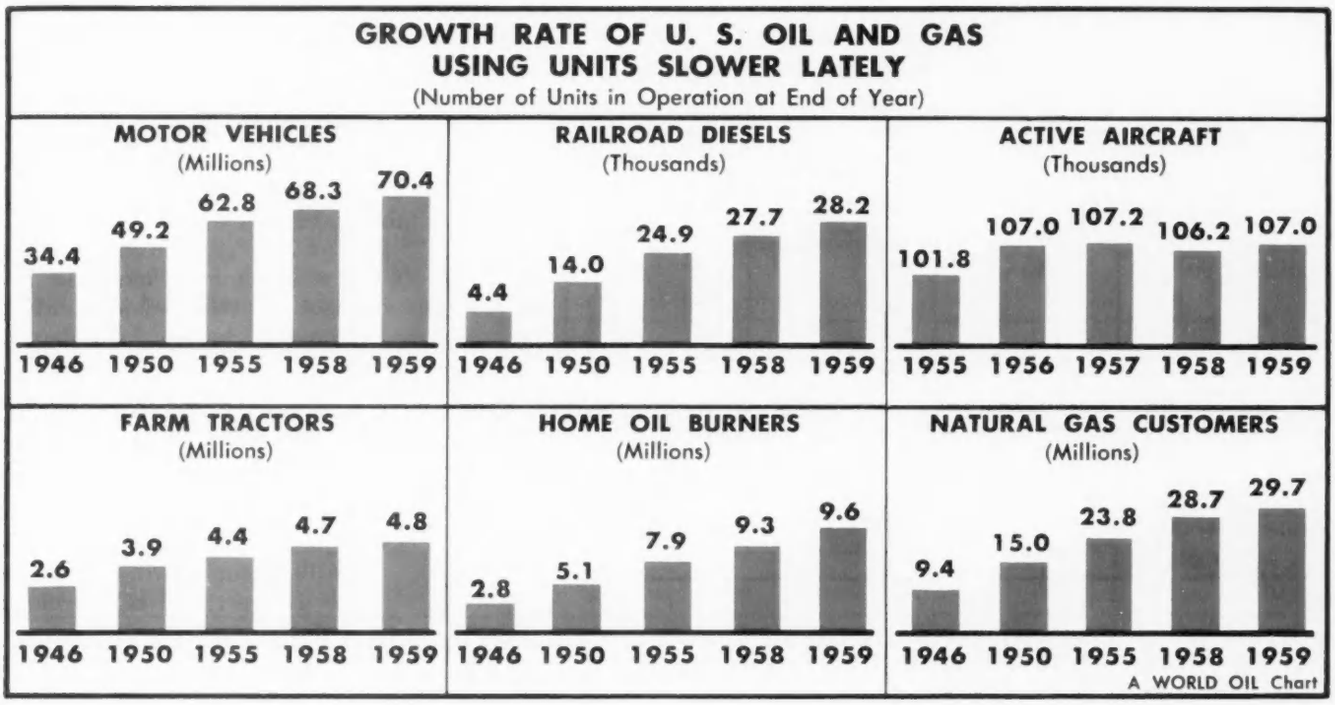
Gasoline stocks increased 2.2 million barrels to a total of 189 million barrels at the start of 1960. However, the day's supply decreased from 47 to 46 during the 12-month period.

U. S. Stocks of All Oils, Crude Oil, Gasoline and Distillate

(Source: Bureau of Mines, except Dec., 1959, estimated . . . Thousands of Barrels.)

END OF YEAR	ALL OILS		CRUDE OIL		GASOLINE		‡DISTILLATE	
	Barrels	Days' Supply	Barrels	Days' Supply	Barrels	Days' Supply	Barrels	Days' Supply
			Refinable		†Motor Fuel			
1918	193,411	165	144,336	125	7,080	28	.....	..
1919	200,383	164	149,356	127	10,638	40	.....	..
1920	209,845	156	149,448	103	11,009	32	.....	..
1921	294,428	203	217,324	150	13,954	39	.....	..
1922	385,349	232	295,708	181	21,043	50	.....	..
1923	492,088	235	340,637	169	25,593	48	.....	..
1924	520,287	236	360,475	171	30,823	50	.....	..
1925	552,464	239	345,863	150	39,273	54	.....	..
1926	527,084	210	315,029	133	39,521	46	.....	..
1927	597,176	231	379,660	155	34,115	36	.....	..
1928	621,010	224	392,629	148	33,742	31	.....	..
1929	689,166	228	428,445	149	42,498	35	.....	..
1930	665,497	224	411,882	153	54,192	43	.....	..
1931	621,673	221	370,194	144	56,171	45	.....	..
1932	590,106	230	339,875	145	53,805	48	.....	..
1933	602,198	226	354,223	140	55,933	50	17,025	..
1934	564,350	199	337,254	128	56,959	48	21,957	..
1935	541,700	178	314,855	109	60,391	47	19,930	71
1936	519,229	155	288,579	91	66,969	48	22,813	68
1937	564,728	154	305,833	87	81,748	54	22,566	56
1938	567,703	156	274,165	79	76,510	49	*36,224	*90
1939	525,838	135	238,910	66	87,286	53	33,718	74
1940	563,277	141	264,079	70	83,647	50	42,940	87
1941	552,328	127	247,499	61	90,596	48	49,926	93
1942	497,940	116	234,889	61	75,404	44	44,940	75
1943	485,698	106	243,506	59	69,505	41	41,728	65
1944	477,089	95	220,862	46	78,073	39	38,333	55
1945	463,579	87	218,763	45	93,682	44	35,778	50
1946	507,094	95	224,473	45	89,515	42	59,620	80
1947	502,053	85	224,929	42	87,407	38	51,081	57
1948	607,856	99	246,572	43	101,060	41	76,001	77
			All Crude					
*1948	605,743	99	256,627	44	101,060	41	*71,429	*72
1949	603,119	98	253,356	46	110,417	42	75,207	80
1950	582,710	86	248,463	42	116,024	42	71,948	64
1951	634,109	85	255,783	39	*135,306	44	*86,619	67
					‡Gasoline			
1952	673,754	87	271,928	40	134,737	42	98,688	71
1953	725,507	91	274,445	39	157,872	46	111,741	78
1954	714,933	88	258,385	37	155,400	46	108,144	75
1955	714,859	81	265,610	35	165,433	46	111,333	70
1956	780,391	85	266,014	34	187,271	49	133,981	75
1957	841,317	90	281,813	35	196,776	50	149,449	82
1958	788,796	84	262,730	34	186,760	47	125,101	68
1959	803,600	83	253,600	32	189,000	46	148,800	79
1960 Est.	812,000	81	253,600	30	.....	....	.....	..

* Revised; new basis. † Finished and natural gasoline. ‡ Finished and unfinished gasoline. ‡ Distillate and residual fuel oils included together prior to 1935.



Oil and gas using units increase at slower rate

THE STRIKE-INDUCED slowdown in steel production combined with other factors to curb the steady annual increase in oil and gas consuming units during 1959, but it failed to stop the totals of principal kinds of units from reaching new record highs.

At the end of 1959, fuel was being purchased in the United States for use by 114.6 million motor vehicles, aircraft, residential oil burners, farm tractors, railroad diesels and natural gas customers. The new total represented an increase of 3.5 million units or 3.1 percent over the number reported at the end of 1958. However, last year's increase was 537,767 units under the average annual increase during the previous three years.

As in 1959, units are expected to continue their climb this year, but at a slower pace than before.

Motor vehicles. Total U.S. motor vehicles in use increased to a high of 70.4 million at the end of 1959, up 2.1 million over 1958. Even so, the increase was 700,000 units under the average annual increase of 2.8 million during the 1955-1958 period.

Active aircraft. The number of active U.S. aircraft increased to about 107,000 at the end of 1959 from 106,200 at the close of 1958. The new total included about 34,800 military and 72,200 civil aircraft.

The total was unchanged from 1956. However, during that year there were 42,300 military and only 64,700 civil planes. Subsequently, military aircraft have decreased in number, while civil have steadily increased.

Aviation gasoline demand has been decreasing. But the decline has been more than offset by gains in jet fuel demand. Resultant gains in total demand for aircraft fuels reflect increased consumption per aircraft. Consumption of both fuels combined increased to a peak of about 529,000 barrels daily in 1959. That was equivalent to a new high of almost 5 barrels or 210 gallons per aircraft per day.

Natural gas customers. The annual rate of increase in natural gas customers dropped to 1 million in 1959, compared with an average of 1.63 million new additions per year during the previous three years.

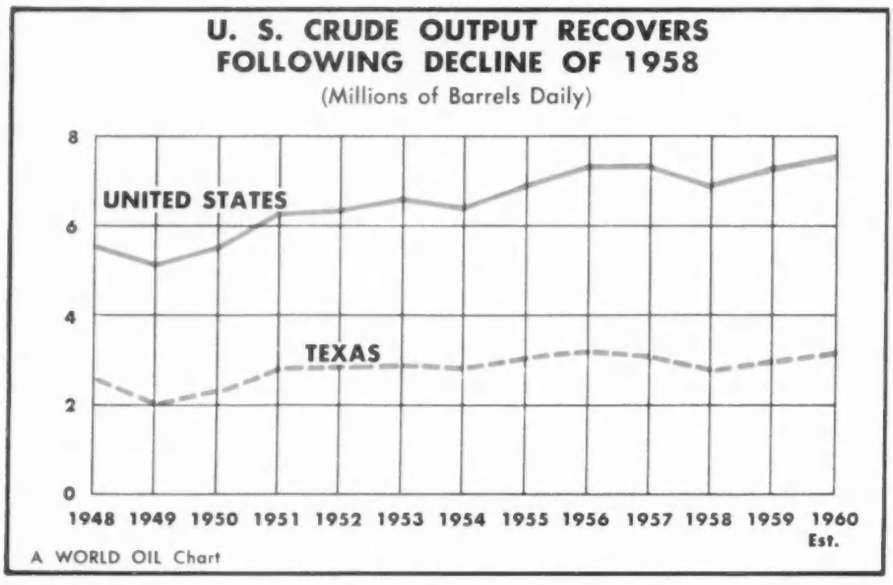
Even so, the 1959 total of 29.7 million customers was more than three times the 9.4 million customers reported in 1946, and nearly twice the total in 1950.

Farm tractors. This group of oil and gas using units totaled 4.8 million operating at the end of 1959—up 100,000 over 1958. The average annual rate of increase in farm tractors has remained constant at 100,000 units since 1950.

Home oil burners. The 9.6 million units operating at year's end represented an increase of 300,000 over the same date in 1958, for a new record high. Although a new record was set, last year's growth rate was considerably lower than the 1955-1958 yearly average increase of 467,000 units.

Railroad diesels. The nation's railroads are adding a steadily decreasing number of diesel locomotives each year. They added 500 units during 1959, and increased the total to 28,200 operating at year's end.

In comparison, an average of 933 units were added annually during the 1955-1958 period, and 2,200 units during 1950-1955.



U.S. crude production to set new record in 1960

EVEN THOUGH IMPORTS, warmer than normal weather and improved but still excessive inventories have been clouding the picture, U.S. crude production is expected to reach a new high in 1960.

According to U.S. Bureau of Mines estimates, requirements for domestic crude production will increase 385,000 barrels daily, or 5.5 percent, to a record total of 7,427,000 barrels daily.

This projection of required production assumes there will be no net additions or withdrawals of crude oil from storage, imports will be held at reasonable levels and the resurging U.S. economy will boost demand for petroleum products by 370,000 barrels daily or 3.8 percent over 1959.

Some improvement was shown last year, as crude output reached levels reasonably close to the record highs of 1956 and 1957. The 1959 average of 7,042,000 barrels of crude produced daily reflected an increase of 332,000 barrels daily or 4.9 percent over 1958. Also, the 1959 average was only 128,000 barrels daily or 1.8 percent under the previous record high of 7,170,000 barrels per day recorded in 1957.

Outlook is promising. The expected 3.8 percent increase in demand for all oils should improve the crude production picture considerably, despite the fact that crude oil imports are expected to be up 2 percent to 975,000 barrels daily in 1960, after holding fairly steady last year.

Part of the gain in demand for all oils will be met by increased production of natural gas liquids, which is expected to be up 4,000 barrels per day, or 0.5 percent over 1959.

Other factors contributing to the optimistic outlook include:

- The somewhat improved inventory position that existed at the start of the year.
- Stepped up efforts by the American Petroleum Institute to stimulate greater use of petroleum products.
- An expected upturn in industrial and residential use of oil products, following settlement of the steel strike.
- The established trend that the greatest growth in per capita demand for energy usually develops during the two years immediately following a general business recession.

Achievement of a satisfactory stocks situation during 1959 was encouraging. In spite of excessive accumulation of inventories during the first half of the year, the December 31 level was not much higher than at the beginning of the year, with stocks of crude and residual fuel oil lower, in fact. Only distillate was significantly higher.

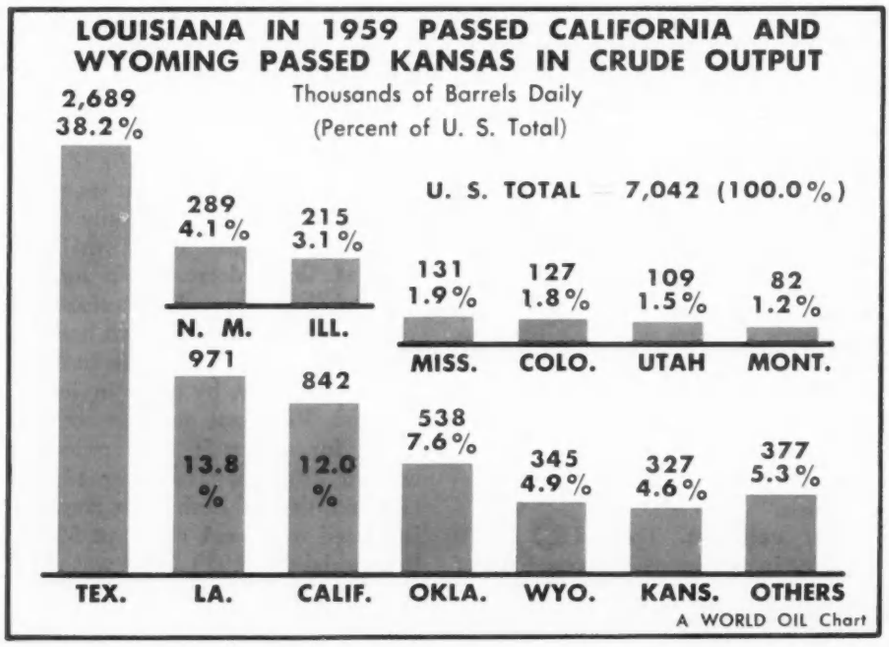
Apart from distillate, petroleum in-

U.S. Crude Oil Production

Source: U.S. Bureau of Mines, except Nov. and Dec., 1959, from American Petroleum Institute.

(THOUSANDS OF BARRELS)

Year	Total	Daily	Year	Total	Daily
.....	.....	....	1939	1,264,962	3,466
.....	.....	....	1940	1,353,214	3,707
1918	355,928	975			
1919	378,367	1,037	1941	1,402,228	3,842
1920	442,929	1,213	1942	1,386,645	3,799
			1943	1,505,613	4,125
1921	472,183	1,294	1944	1,677,904	4,584
1922	557,531	1,528	1945	1,713,655	4,695
1923	732,407	2,007			
1924	713,940	1,956	1946	1,733,939	4,750
1925	763,743	2,092	1947	1,856,987	5,088
			1948	2,020,185	5,520
1926	770,874	2,112	1949	1,841,940	5,046
1927	901,129	2,469	1950	1,973,574	5,407
1928	901,474	2,469			
1929	1,007,323	2,760	1951	2,247,711	6,158
1930	898,011	2,460	1952	2,289,836	6,256
			1953	2,357,082	6,458
1931	851,081	2,332	1954	2,314,988	6,342
1932	785,159	2,151	1955	2,484,428	6,807
1933	905,656	2,481			
1934	908,065	2,488	1956	2,617,283	7,151
1935	996,596	2,730	1957	2,616,901	7,170
			1958	2,448,987	6,710
1936	1,099,687	3,013	1959	2,570,379	7,042
1937	1,279,160	3,505	1960		
1938	1,214,355	3,327	Est	2,718,282	7,427



ventories are now in much better position than might have been predicted last June. The marked improvement achieved since that time stems, of course, from the substantial liquidation of stocks that resulted from a severe cutback in production during the last six months of 1959.

Present indications are that petroleum inventories at the end of 1960 should not be materially higher than they were at the close of 1959. Thus, the average rate of new oil supply should equal or surpass the demand volume, depending on the quotas established for imports.

Report by states. Seven states accounted for 88.2 percent of all U.S. crude production in 1959, with four of the leading states reporting production increases.

Texas increased its crude output 4.4 percent to 2,688,600 barrels daily (38.2 percent of the U.S. total); Louisiana production increased 12.9 percent to 971,085 barrels daily; Wyoming was up 8.9 percent, and New Mexico up 7.1 percent.

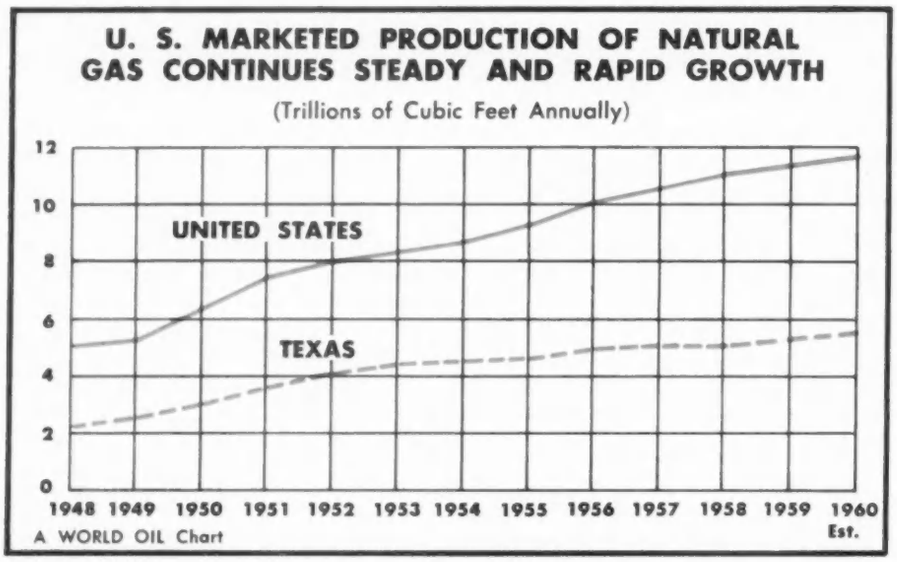
Major producing states showing decreases included California, down 2 percent to 842,038 barrels daily; Kansas, down 0.4 percent and Oklahoma down 2.2 percent.

U. S. Crude Oil Production, by States and Districts, 1958, 1959, and Cumulative Since Beginning

(Sources: U. S. Bureau of Mines, except November and December, 1959, from API; Texas districts from API and Texas Railroad Commission; and Louisiana district cumulatives from other sources.)

STATE or DISTRICT	Daily Average Production (Actual Bbls.)			Annual Production (Thousand Bbls.)		Year's Production As % of U.S.		Cumulative Prod. to Dec. 31, 1959 (Thousand Bbls.)	
	1959	1958	% Diff. '59-'58	1959	1958	1959	1958	Total	As % of U.S.
Alabama	**14,006**	**16,129**	**— 13.2**	**5,112**	**5,887**	**0.19**	**0.24**	**29,125**	**0.04**
Alaska	**526**	.....	**+100.0**	**192**	.....	**0.01**	.....	**192**	.....
Arizona	**74**	**33**	**+124.2**	**27**	**12**	.....	.....	**39**	.....
Arkansas	**70,775**	**78,630**	**— 10.0**	**25,833**	**28,700**	**1.01**	**1.17**	**1,057,455**	**1.68**
California	**842,038**	**859,375**	**— 2.0**	**307,344**	**313,672**	**11.95**	**12.81**	**11,720,787**	**18.65**
Colorado	**126,556**	**133,523**	**— 5.2**	**46,193**	**48,736**	**1.80**	**1.99**	**548,902**	**0.87**
Florida	**1,175**	**1,230**	**— 4.5**	**429**	**449**	**0.02**	**0.01**	**6,171**	**0.01**
Illinois	**215,049**	**219,932**	**— 2.2**	**78,493**	**80,275**	**3.05**	**3.28**	**2,152,092**	**3.42**
Indiana	**32,764**	**32,504**	**+ 0.8**	**11,959**	**11,864**	**0.47**	**0.49**	**306,873**	**0.49**
Kansas	**327,255**	**328,608**	**— 0.4**	**119,448**	**119,942**	**4.64**	**4.89**	**3,171,612**	**5.05**
Kentucky	**72,523**	**47,970**	**+ 51.2**	**26,471**	**17,509**	**1.03**	**0.72**	**395,250**	**0.63**
***Louisiana**	**971,085**	**859,975**	**+ 12.9**	**354,446**	**313,891**	**13.79**	**12.82**	**5,109,080**	**8.12**
North Louisiana	121,975	113,789	+ 7.2	44,521	41,533	1.74	1.70	1,138,489	1.81
South Louisiana	849,110	746,186	+ 13.8	309,925	272,358	12.05	11.12	3,282,108	5.22
Michigan	**28,548**	**25,501**	**+ 11.9**	**10,420**	**9,308**	**0.41**	**0.38**	**425,641**	**0.68**
Mississippi	**131,427**	**108,252**	**+ 21.4**	**47,971**	**39,512**	**1.87**	**1.61**	**632,238**	**1.01**
Missouri	.....	**230**	**—100.0**	.....	**84**	.....	.....	**1,044**	.....
Montana	**82,060**	**76,595**	**+ 7.1**	**29,952**	**27,957**	**1.16**	**1.14**	**335,425**	**0.53**
Nebraska	**64,126**	**55,816**	**+ 14.9**	**23,406**	**20,373**	**0.91**	**0.84**	**117,501**	**0.19**
Nevada	**91**	**110**	**— 17.3**	**33**	**40**	.....	.....	**278**	.....
***New Mexico**	**289,154**	**269,904**	**+ 7.1**	**105,541**	**98,515**	**4.11**	**4.02**	**1,408,722**	**2.24**
Southeast New Mexico	249,488	246,477	+ 1.2	91,063	89,964	3.55	3.67	1,275,988	2.03
Northwest New Mexico	39,666	23,427	+ 69.3	14,478	8,551	0.56	0.35	27,334	0.04
New York	**5,408**	**4,830**	**+ 12.0**	**1,974**	**1,763**	**0.08**	**0.07**	**204,630**	**0.32**
North Dakota	**49,211**	**39,066**	**+ 26.0**	**17,962**	**14,259**	**0.69**	**0.59**	**82,900**	**0.14**
Ohio	**14,915**	**17,151**	**— 13.0**	**5,444**	**6,260**	**0.22**	**0.25**	**661,299**	**1.05**
Oklahoma	**537,545**	**549,860**	**— 2.2**	**196,204**	**200,699**	**7.63**	**8.20**	**8,057,432**	**12.81**
Pennsylvania	**16,660**	**17,732**	**— 6.1**	**6,081**	**6,472**	**0.24**	**0.26**	**1,204,990**	**1.92**
South Dakota	**326**	**159**	**+105.0**	**119**	**58**	.....	.....	**330**	.....
Tennessee	**17**	**19**	**— 10.5**	**6**	**7**	.....	.....	**604**	.....
***Texas**	**2,688,600**	**2,575,797**	**+ 4.4**	**981,339**	**940,166**	**38.18**	**38.39**	**22,905,184**	**36.44**
Dist. 1: South Central	45,425	46,255	— 1.8	16,580	16,883	0.65	0.69	448,145	0.72
Dist. 2: Middle Gulf	117,885	116,236	+ 1.4	43,028	42,426	1.67	1.73	1,030,596	1.64
Dist. 3: Upper Gulf	379,795	377,682	+ 0.6	138,625	137,854	5.39	5.63	4,069,623	6.47
Dist. 4: Lower Gulf-S.W.	190,608	190,526	.....	69,572	69,542	2.71	2.84	1,696,597	2.70
Dist. 5: East Central	29,367	30,044	— 2.3	10,719	10,966	0.42	0.45	651,200	1.03
Dist. 6: Northeast	262,441	259,364	+ 1.2	95,791	94,668	3.72	3.87	3,686,261	5.87
Dist. 7-B: North Central	135,460	136,951	— 1.1	49,443	49,987	1.93	2.04	900,433	1.43
Dist. 7-C: West Central	128,047	133,633	— 4.2	46,737	48,776	1.82	1.99	760,308	1.21
Dist. 8: West	1,055,101	958,027	+ 10.1	385,112	349,680	14.98	14.28	5,573,604	8.86
Dist. 9: North	206,564	200,789	+ 2.9	75,396	73,288	2.93	2.99	1,738,706	2.77
Dist. 10: Panhandle	107,819	100,516	+ 7.3	39,354	36,688	1.53	1.50	970,204	1.54
Utah	**109,482**	**67,975**	**+ 61.1**	**39,961**	**24,811**	**1.55**	**1.02**	**82,462**	**0.13**
Virginia	**14**	**11**	**+ 27.3**	**5**	**4**	.....	.....	**250**	.....
West Virginia	**5,940**	**5,989**	**— 0.8**	**2,168**	**2,186**	**0.09**	**0.09**	**463,327**	**0.74**
Washington	**3**	**11**	**— 72.7**	**1**	**4**	.....	.....	**10**	.....
Wyoming	**344,781**	**316,636**	**+ 8.9**	**125,845**	**115,572**	**4.90**	**4.72**	**1,784,266**	**2.84**
Unclassified	.....	.....	.....	.....	.....	.....	.....	**572**	.....
Total United States	**7,042,134**	**6,709,553**	**+ 5.0**	**2,570,379**	**2,448,987**	**100.00**	**100.00**	**62,866,683**	**100.00**

*** Data on Louisiana, New Mexico and Texas by districts are from various sources and do not necessarily agree with state totals, which are on Bureau of Mines basis.**



Natural gas production and use are expanding steadily

U.S. PRODUCERS of natural gas will have a ready market for a new record volume of output in 1960. Marketed production increased by 3.3 percent in the recession year 1958 and the same amount in strike-troubled 1959. It promises to increase by a larger percentage during the expected boom of 1960.

Assuring a good market for natural gas is the gas industry's continuing vigorous expansion of pipe line systems and other facilities. More potential customers want natural gas, and it is being provided.

Prices at well. To obtain additional gas, purchasers have been steadily increasing the prices they will pay for it at the well, although restricted by governmental controls. The average price paid for gas at the well in the United States was 11.3 cents per thousand cubic feet in 1957, advanced to 11.9 cents in 1958, and further increased to 12.1 cents in 1959.

In many areas the price at the well remains under 9 cents a thousand cubic feet, under old contracts. Prices range on up as high as 22 cents in South Louisiana under new contracts.

A gas well now may be more profitable than an oil well, because of low oil allowables and other factors. In the United States in 1959, gas wells yielded an average output of 307 thousand cubic feet daily per well. At the national average price of 12.1 cents per thousand at the well, the average well produced $37.14 worth of gas per day. The average U.S. oil well produced 12.1 barrels of crude per day, worth $2.94 per barrel or a total of $35.57 for the day's output. Thus the gas well provided $1.57 per day more of revenue than the oil well.

While gradually improving, the prices received by producers for natural gas remain lower than justified by the energy value of the gas or present high costs of drilling for gas. Many producers are deterred from more active gas development by inadequate gas prices and dangers in government control of gas prices and production.

Nevertheless, nearly 5,000 gas and gas-condensate wells were drilled in 1959, and a similar number is expected in 1960. The number of U.S. producing gas wells increased to a new all time high of 86,256 at the end of 1959, and active drilling of new wells will boost the total during 1960.

Production. Marketed production of natural gas in the United States set a new record of 11.4 trillion cubic feet in 1959, compared with 11.0 trillion in 1958, and 10.7 trillion in 1957. A

Marketed Production and Value of Natural Gas, by States
(Source: U.S. Bureau of Mines, except 1959 estimated.)

STATE	PRODUCTION (Million Cubic Feet) ANNUAL Est. 1959	1958	1957	Cumulative To End of 1959	EST. VALUE AT WELLS, (Thous. Dollars) 1958	1957
Alabama	350	323	190	1,322	30	12
Arizona				36		
Arkansas	33,000	32,890	31,327	1,123,669	2,664	2,256
California	477,000	465,582	492,338	14,951,879	108,481	116,684
Colorado	80,000	82,464	95,259	591,365	8,659	9,526
Florida	35	35	34	361	5	4
Illinois	15,000	12,983	9,647	367,301	1,921	1,495
Indiana	350	378	671	570,391	59	88
Kansas	480,000	561,816	586,690	7,878,085	64,047	66,883
Kentucky	85,000	72,248	70,024	2,034,706	17,412	16,666
Louisiana	2,670,000	2,451,587	2,078,901	26,147,693	316,255	232,837
Maryland	4,100	4,266	4,649	29,719	1,148	1,218
Michigan	19,000	14,243	9,122	333,043	2,649	1,715
Mississippi	166,000	160,143	169,967	1,876,436	22,260	17,507
Missouri			12	11,458		2
Montana	29,000	27,989	28,638	826,164	1,903	2,062
Nebraska	17,500	11,405	14,249	92,239	1,711	2,280
New Mexico	758,000	761,446	723,004	6,592,808	79,190	67,962
New York	2,800	2,808	2,869	448,626	859	815
North Dakota	20,500	17,325	15,450	75,813	1,672	1,468
Ohio	34,000	31,786	30,384	2,973,660	6,802	7,201
Oklahoma	750,000	696,504	719,794	15,824,215	70,347	59,743
Pennsylvania	96,000	95,869	101,801	7,228,778	27,131	31,660
South Dakota				1,101		
Tennessee	65	54	38	3,455	9	6
Texas	5,300,000	5,178,073	5,156,215	70,271,699	517,807	500,153
Utah	40,000	19,247	16,824	208,321	2,829	2,473
Virginia	2,300	2,521	2,465	18,263	681	661
Washington				854		
West Virginia	208,000	204,581	202,440	10,408,927	50,734	48,181
Wyoming	112,000	121,682	117,256	1,923,911	10,221	10,201
Others				47,640		
Total, U.S.	11,400,000	11,030,248	10,680,258	172,863,938	1,317,486	1,201,759

further rise in 1960 to at least 11.8 trillion (3.6 percent) may be conservatively forecast.

In addition to the amount marketed, U.S. gas and oil wells in 1959 produced an estimated 1.5 trillion cubic feet of gas used for repressuring oil fields and 700 billion feet vented and wasted. Gross production thus totaled 13.6 trillion cubic feet, compared with 13.2 trillion in 1958 and 12.9 trillion in 1957.

Of the 13.6 trillion cubic feet of gross production in 1959, 9.5 trillion feet or 69.9 percent came from gas wells and 4.1 trillion or 30.1 percent from oil wells. The proportion supplied by gas wells has been gradually increasing, and the percentage furnished by oil wells has decreased.

Consumption. Actual consumption of natural gas always runs slightly short of marketed production. The deficiency represents gas lost in transmission or otherwise unaccounted for. The 11.2 trillion cubic feet consumed in 1959 had a total value of about $5,355,000,000 at points of consumption, an average of 47.8 cents per thousand cubic feet.

The total consumption included 2.9 trillion cubic feet used by 30.3 million residential consumers at a cost of $2.9 billion or $1.00 per thousand cubic feet. About 2,460,000 commercial customers consumed 900 billion cubic feet at a cost of $630 million or 70 cents per thousand feet.

Industrial consumption amounted to 7.4 trillion cubic feet, valued at $1,825,000,000, or 24.7 cents per thousand. This included some gas used in the fields at 12 cents per thousand, some in carbon black plants at 8.7 cents, and over 5.5 trillion feet used as industrial fuel by refineries, natural gas pipe lines, cement plants, electric utility plants, and other plants, at a cost of about $1.6 billion or an average price of 29 cents per thousand feet.

During 1959 the 11.4 trillion cubic feet of marketed production included an estimated 6.8 trillion feet or 60 percent that moved interstate. Shipments across state lines accounted for only 58.4 percent in 1958 and 56.6 percent in 1957. Increases in interstate shipments largely account for the big increases each year in total gas marketed.

U.S. Production and Consumption of Natural Gas, by Years, 1959, 1958 and 1957

(Source: 1959 estimated; 1958 and 1957 from U.S. Bureau of Mines.)
UNITS EXPLAINED IN FOOTNOTE NO. 1

Classification[1]	Est. 1959[5]	1958	1957
PRODUCTION			
Wells: Gas wells drilled	[6]4,931	3,674	3,912
Producing gas wells, Dec. 31 (dry gas)	[6]86,256	80,400	77,041
Production: Gross Production	13,600,000	13,146,635	12,906,669
Source: (1). From gas wells	9,500,000	9,154,051	8,716,835
(2). From oil wells	4,100,000	3,992,584	4,189,834
Disposition: (1). Repressuring	1,500,000	1,482,975	1,417,263
(2). Vented and Wasted	700,000	633,412	809,148
(3). Marketed production[2]	11,400,000	11,030,248	10,680,258
Value at wells	1,379,400	1,317,486	1,201,759
Avg. value at wells	12.1	11.9	11.3
Underground storage: Net stored	100,000	83,081	191,396
Total stored	775,000	704,172	672,377
Total withdrawn	675,000	621,091	480,981
Interstate shipments[3]	[7]6,840,000	[7]6,439,570	[7]6,047,771
Imports	140,000	135,797	37,941
Exports	40,000	38,719	41,655
Treated at natural gasoline plants	8,800,000	8,452,544	8,578,561
CONSUMPTION			
Residential: Volume Consumed	2,900,000	2,714,251	2,500,269
Number of consumers	30,300,000	29,382,000	28,792,000
Value at point of consumption	2,900,000	2,665,385	2,324,790
Avg. value at point of consumption	100.0	98.2	93.0
Commercial: Volume Consumed	900,000	871,774	775,916
Number of consumers	2,460,000	2,405,000	2,344,000
Value at point of consumption	630,000	605,818	534,485
Avg. value at point of consumption	70.0	69.5	68.9
Industrial: Volume consumed, Total	7,400,000	7,174,623	7,003,590
Field	1,650,000	1,604,104	1,479,720
Carbon Black	200,000	211,048	233,788
Industrial Fuel[4]	5,550,000	5,359,471	5,290,082
Petroleum refineries	685,000	681,912	678,810
Natural gas pipe lines	320,000	312,221	299,235
Electric utility plants	1,415,000	1,372,853	1,338,079
Value at point of consumption, Total Industrial	1,825,000	1,696,695	1,575,949
Field	198,100	184,609	162,397
Carbon Black	17,400	17,877	19,319
Industrial Fuel[4]	1,609,500	1,494,209	1,394,233
Avg. value at point of consumption, Total Industrial	24.7	23.6	22.5
Field	12.0	11.5	11.0
Carbon Black	8.7	8.5	8.3
Industrial Fuel[4]	29.0	27.9	26.4
Total Consumption: Volume consumed	11,200,000	10,760,648	10,279,775
Value at point of consumption	5,355,000	4,967,898	4,435,224
Avg. value at point of consumption	47.8	46.2	43.1

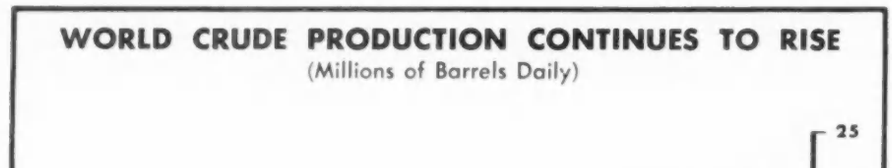
[1] Units.—Volume: million cubic feet. No. of consumers: actual. Value: thousand dollars. Avg. value: cents per Mcf. [2]Includes gas stored and lost in transmission. [3]Includes exports. [4]Petroleum refineries, natural gas pipe lines, portland cement plants, electric utility plants etc. included in "Industrial Fuel." [5]Estimated with aid of reports of Bureau of Mines and American Gas Association. [6]WORLD OIL statistics. [7]Quantity received.

Gross Withdrawals and Disposition of Natural Gas in U.S. in 1958, in Million Cubic Feet

(Source: U.S. Bureau of Mines Mineral Market Report MMS No. 2972)

STATE	GROSS WITHDRAWALS[1]			DISPOSITION		
	From Gas Wells	From Oil Wells	Total	Marketed Production[2]	Repressuring	Vented and Wasted[3]
Arkansas	23,000	45,000	68,000	32,890	28,180	6,930
California	133,000	575,000	708,000	465,582	241,141	1,277
Colorado	44,000	124,000	168,000	82,464	45,145	40,391
Illinois	3,000	18,000	21,000	12,983	47	7,970
Indiana	300	3,600	3,900	378		3,522
Kansas	529,000	61,000	590,000	561,816	421	27,763
Kentucky	70,000	3,000	73,000	72,248		752
Louisiana	2,223,000	505,000	2,728,000	2,451,587	220,616	55,797
Maryland	4,266		4,266	4,266		
Michigan	12,000	5,000	17,000	14,243	1,893	864
Mississippi	179,000	79,000	258,000	160,143	73,204	24,653
Montana	23,000	8,000	31,000	27,989	942	2,069
Nebraska	7,000	10,000	17,000	11,405	394	5,201
New Mexico	513,000	268,000	781,000	761,446	10,686	8,868
New York	2,900	200	3,100	2,808		292
North Dakota	2,000	18,000	20,000	17,325		2,675
Ohio	28,900	5,000	33,900	31,786	50	2,064
Oklahoma	530,000	510,000	1,040,000	696,504	99,546	243,950
Pennsylvania	101,000	3,000	104,000	95,869	162	7,969
Texas	4,417,000	1,666,000	6,083,000	5,178,073	743,409	161,518
Utah	17,000	11,400	28,400	19,247	1,036	8,117
Virginia	2,600		2,600	2,521		79
West Virginia	201,000	4,000	205,000	204,581	111	308
Wyoming	88,000	70,000	158,000	121,682	15,992	20,326
Other States[4]	85	384	469	412		57
Total	9,154,051	3,992,584	13,146,635	11,030,248	1,482,975	633,412

[1] Marketed production plus quantities used in repressuring, vented, and wasted.
[2] Comprises gas sold or consumed by producers, including losses in transmission, quantities added to storage, and increases in gas in pipelines.
[3] Partly estimated. Includes direct waste on producing properties and residue blown to the air.
[4] Alabama, Arizona, Florida, Missouri, and Tennessee.



World crude production to climb again in 1960

WORLD CRUDE OIL PRODUCTION is expected to rise to a new record high of 20,736,902 barrels daily in 1960. This would represent an increase of 1,280,729 barrels or 6.6 percent over the 19,456,173 barrels daily of 1959.

U.S. crude oil production is expected to rise 384,866 barrels daily or 5.5 percent to 7,427,000 barrels per day in 1960. Canadian output is expected to rise about 40,000 barrels or 8 percent to about 540,000 barrels daily. Production of all other countries combined is estimated at 12,769,902 barrels daily in 1960, an increase of 856,236 barrels or 7.2 percent.

South America. In Argentina, completion of the 1,000-mile, 24-inch gas line from Salta to Buenos Aires, and of a smaller line to move Salta crude to refining facilities is expected to be a great boon to the country's economy. Increases in crude oil output, and replacement of formerly imported residual fuel oil by natural gas, are counted on to relieve Argentina of the need to import fuel.

Venezuela, on the other hand, may suffer a decrease in output. As the world's largest oil exporter, Venezuela may bear the brunt of loss of markets, owing to such countries as Argentina becoming self-sufficient in oil in the future. Many factors, such as U.S. import restrictions, the increase of Soviet oil on the world's markets, the advent of large-scale production in the Sahara, and the currently adverse taxes and political climate in Venezuela, are threatening Venezuela's production and markets.

Europe. Russia overtook Venezuela as the world's second largest crude producer in 1959, and may surpass Venezuela's output by a greater margin in 1960.

In West Germany, crude production is running at about 100,000 barrels daily.

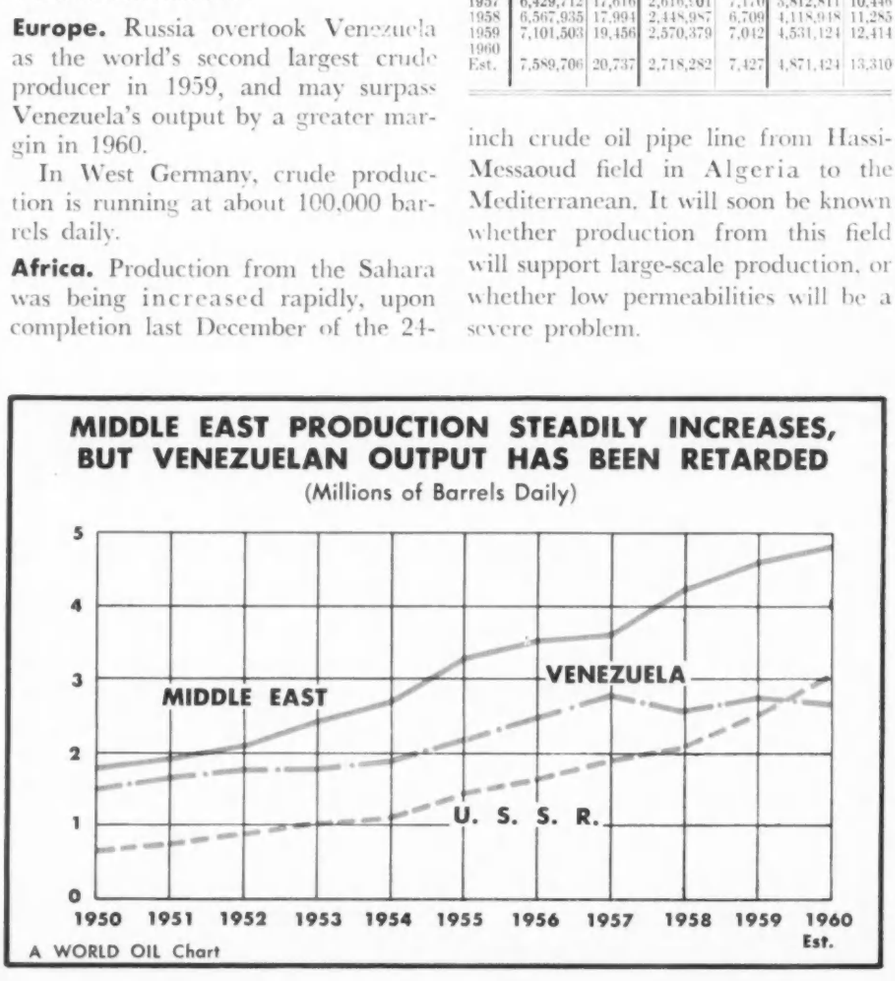
Africa. Production from the Sahara was being increased rapidly, upon completion last December of the 24-inch crude oil pipe line from Hassi-Messaoud field in Algeria to the Mediterranean. It will soon be known whether production from this field will support large-scale production, or whether low permeabilities will be a severe problem.

Crude Oil Production of World, U.S., and Countries Outside U.S., by Years

(Source: U.S. Bureau of Mines except 1958 and forecast for 1959 outside U.S. estimated by WORLD OIL.)

(THOUSANDS OF BARRELS)

Year	WORLD		U.S.		OUTSIDE U.S.	
	Total	Daily	Total	Daily	Total	Daily
1918	503,515	1,378	355,928	975	147,587	403
1919	555,875	1,523	378,367	1,037	177,508	486
1920	688,884	1,887	442,929	1,213	245,955	674
1921	766,002	2,098	472,183	1,294	293,819	804
1922	858,898	2,353	557,531	1,528	301,367	825
1923	1,015,736	2,783	732,407	2,007	283,329	776
1924	1,014,318	2,779	713,940	1,956	300,378	823
1925	1,068,933	2,928	763,743	2,092	305,190	836
1926	1,096,823	3,005	770,874	2,112	325,949	893
1927	1,262,582	3,459	901,129	2,469	361,453	990
1928	1,324,774	3,629	901,474	2,469	423,300	1,160
1929	1,485,867	4,071	1,007,323	2,760	478,544	1,311
1930	1,410,037	3,863	898,011	2,460	512,626	1,403
1931	1,372,532	3,760	851,081	2,332	521,451	1,428
1932	1,309,677	3,588	785,159	2,151	524,518	1,437
1933	1,422,146	3,951	905,656	2,481	536,490	1,470
1934	1,522,281	4,170	908,065	2,488	614,216	1,682
1935	1,654,488	4,532	996,596	2,730	657,892	1,802
1936	1,791,540	4,908	1,099,687	3,013	691,853	1,895
1937	2,039,231	5,587	1,279,160	3,505	760,071	2,082
1938	1,988,041	5,446	1,214,355	3,327	773,686	2,119
1939	2,086,160	5,716	1,264,962	3,466	821,198	2,250
1940	2,149,821	5,874	1,353,214	3,697	796,607	2,177
1941	2,220,657	6,084	1,402,228	3,842	818,429	2,242
1942	2,093,100	5,735	1,386,645	3,799	706,455	1,935
1943	2,256,637	6,183	1,505,613	4,125	751,034	2,058
1944	2,592,289	7,083	1,677,904	4,584	914,385	2,498
1945	2,594,697	7,109	1,173,665	4,695	881,042	2,414
1946	2,745,430	7,522	1,733,939	4,751	1,011,491	2,771
1947	3,022,139	8,280	1,856,987	5,088	1,165,152	3,192
1948	3,433,234	9,380	2,020,185	5,520	1,413,049	3,861
1949	3,404,132	9,326	1,841,940	5,046	1,562,192	4,280
1950	3,802,955	10,419	1,973,574	5,407	1,829,421	5,012
1951	4,282,730	11,734	2,247,711	6,158	2,035,019	5,576
1952	4,504,708	12,308	2,289,836	6,256	2,214,872	6,052
1953	4,786,989	13,115	2,357,082	6,458	2,429,907	6,657
1954	5,006,205	13,716	2,314,988	6,342	2,691,217	7,374
1955	5,641,439	15,456	2,484,428	6,807	3,157,011	8,649
1956	6,101,967	16,672	2,617,283	7,151	3,484,684	9,521
1957	6,429,712	17,616	2,616,601	7,170	3,812,811	10,446
1958	6,567,935	17,994	2,448,987	6,709	4,118,948	11,285
1959	7,101,503	19,456	2,570,379	7,042	4,531,124	12,414
1960 Est.	7,589,706	20,737	2,718,282	7,427	4,871,424	13,310

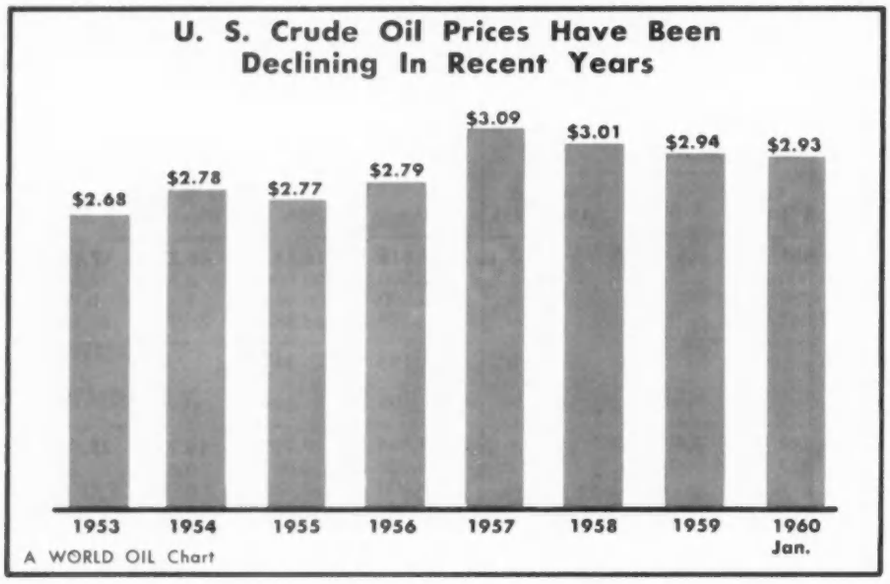


World Crude Oil Production, by Countries, Recent Years, and Cumulative Through 1959

(Sources: Private sources or estimated by WORLD OIL, except cumulative prior to 1958 from U.S. Bureau of Mines)

Continent and Country	Daily Average Production (Actual Barrels) Est. 1960	1959	1958	% Diff. 1959-1958	Annual Production (Thous. Bbls.) 1959	1958	Prod. In 1959 As % of World	Cumulative to End of 1959 (Thous. Bbls.)
North America	**8,277,000**	**7,832,370**	**7,438,718**	**+ 5.3**	**2,858,815**	**2,715,132**	**40.23**	**67,447,106**
Canada	540,000	500,373	453,435	+10.4	182,636	165,504	2.57	1,308,684
Mexico	310,000	289,863	275,730	+ 5.1	105,800	100,641	1.49	3,271,739
United States	7,427,000	7,042,134	6,709,553	+ 5.0	2,570,379	2,448,987	36.17	62,866,683
West Indies	**400**	**529**	**941**	**—43.8**	**193**	**344**	.....	**4,344**
Barbados	.....	.....	.....	.....	.....	.....	.....	8
Cuba	400	529	941	—43.8	193	344	.....	4,336
South America	**3,338,900**	**3,289,877**	**3,070,682**	**+ 7.1**	**1,200,805**	**1,120,799**	**16.92**	**15,881,171**
Argentina	160,000	119,521	97,801	+22.2	43,625	35,697	0.62	739,988
Bolivia	10,200	8,767	9,413	— 6.9	3,200	3,436	0.04	25,032
Brazil	85,000	64,630	51,846	+24.7	23,590	18,924	0.34	62,980
Chile	20,700	17,611	15,255	+15.4	6,428	5,568	0.09	27,745
Colombia	155,000	144,658	128,492	+12.6	52,800	46,900	0.74	891,625
Ecuador	8,000	7,945	8,516	— 6.7	2,900	3,108	0.04	76,981
Peru	45,000	48,066	51,320	— 6.4	17,544	18,732	0.25	558,292
Trinidad	115,000	110,734	102,343	+ 8.2	40,418	37,355	0.57	666,835
Venezuela	2,740,000	2,767,945	2,605,696	+ 6.2	1,010,300	951,079	14.23	12,831,693
Europe	**3,557,450**	**3,072,241**	**2,614,559**	**+17.5**	**1,121,369**	**954,314**	**15.80**	**14,771,062**
Albania	8,500	7,600	7,370	+ 3.1	2,774	2,690	0.04	34,506
Austria	49,000	46,260	53,557	—13.6	16,885	19,549	0.24	254,206
Bulgaria	5,000	5,000	4,795	+ 4.3	1,825	1,750	0.02	8,169
Czechoslovakia	2,500	2,500	2,228	+12.2	913	813	0.01	13,325
France	32,000	30,800	27,506	+12.0	11,242	10,040	0.16	72,787
Germany, East	800	175	89	+96.6	64	33	.....	129
Germany, West	102,000	99,244	86,204	+15.1	36,224	31,464	0.51	307,128
Hungary	30,000	17,000	17,330	— 1.9	6,205	6,325	0.09	112,596
Italy	1,560	1,564	1,432	+ 9.2	571	522	0.01	39,782
Sicily	28,440	28,507	26,098	+ 9.2	10,405	9,526	0.15	
Netherlands	35,000	33,863	30,925	+ 9.5	12,360	11,288	0.17	85,840
Poland	5,000	5,000	3,557	+40.6	1,825	1,298	0.03	292,844
Rumania	241,000	232,000	231,471	+ 0.2	84,680	84,487	1.19	1,898,799
United Kingdom	1,650	1,649	1,651	— 0.1	602	603	0.01	9,128
U.S.S.R. (Russia)	3,000,000	2,550,000	2,111,397	+20.8	930,750	770,660	13.11	11,620,338
Yugoslavia	15,000	11,079	8,949	+23.8	4,044	3,266	0.06	21,485
Africa	**195,750**	**102,830**	**86,510**	**+18.9**	**37,533**	**31,576**	**0.52**	**336,081**
Algeria	80,000	17,000	8,887	+91.3	6,205	3,244	0.08	12,110
Angola	900	884	987	—10.4	323	360	0.01	819
Egypt	70,000	59,507	60,268	— 1.3	21,720	21,998	0.30	300,682
French Equatorial Africa	18,000	14,433	9,817	+47.0	5,268	3,583	0.08	10,132
Morocco	1,850	1,866	1,534	+21.6	681	560	0.01	7,162
Nigeria	25,000	9,140	5,017	+82.2	3,336	1,831	0.04	5,176
Asia, Middle East	**4,774,432**	**4,587,108**	**4,269,884**	**+ 7.4**	**1,674,294**	**1,558,507**	**23.59**	**14,332,257**
Bahrain	44,932	45,133	40,748	+10.8	16,473	14,873	0.24	229,918
Iran	1,000,000	925,000	826,098	+12.0	337,625	301,526	4.75	3,768,119
Iraq	875,000	837,000	729,047	+14.8	305,505	266,102	4.31	2,355,459
Israel	2,000	1,997	1,781	+12.1	729	650	0.01	1,925
Kuwait	1,400,000	1,390,000	1,395,569	— 0.4	507,350	509,382	7.14	3,655,732
Neutral Zone	125,000	113,819	80,301	+41.7	41,544	29,310	0.59	120,581
Qatar	170,000	171,590	175,096	— 2.0	62,630	63,910	0.88	388,936
Saudi Arabia	1,150,000	1,095,399	1,015,029	+ 7.9	399,821	370,486	5.63	3,800,160
Turkey	7,500	7,170	6,215	+15.4	2,617	2,268	0.04	11,427
Asia, Far East	**104,060**	**91,528**	**75,310**	**+21.5**	**33,408**	**27,488**	**0.47**	**688,876**
Burma	9,400	9,351	9,300	+ 0.5	3,413	3,395	0.05	
India	8,500	8,504	8,600	— 1.1	3,104	3,139	0.04	400,237
Pakistan	6,500	6,225	5,607	+11.0	2,272	2,047	0.03	
China	72,000	60,000	44,600	+34.5	21,900	16,279	0.31	67,806
Japan	7,600	7,413	7,160	+ 3.5	2,706	2,613	0.04	119,102
Sakhalin	.....	.....	.....	.....	.....	.....	.....	*101,240
Taiwan (Formosa)	60	35	43	—18.7	13	15	.....	491
Oceania	**488,910**	**479,688**	**437,740**	**+ 9.6**	**175,086**	**159,775**	**2.47**	**2,679,078**
Indonesia	375,000	365,658	325,990	+12.2	133,465	118,986	1.88	2,086,834
Sarawak & Brunei (Br. Borneo)	110,000	109,589	106,632	+ 2.8	40,000	38,921	0.56	567,454
West New Guinea	3,900	4,430	5,105	—13.2	1,617	1,863	0.03	24,674
New Zealand	10	11	13	—15.4	4	5	.....	116
World Undistributed	.....	.....	.....	.....	.....	.....	.....	**1,044**
TOTAL, WORLD	**20,736,902**	**19,456,173**	**17,994,342**	**+ 8.1**	**7,101,503**	**6,567,935**	**100.0**	**116,141,019**

* Sakhalin included with U.S.S.R. in Europe after 1951.



Steadier crude oil prices in prospect following declines

IT IS HOPED THAT CRUDE OIL prices will be stable and possibly improve in 1960, following declines of the past two years. Stronger crude markets are promised by improving markets for refined products, increased demand for oils, effective balancing of supply with demand and satisfactory levels of crude and product inventories.

Crude oil prices have been declining since they reached an 85-year high of $3.09 per barrel in 1957, following the Suez crisis. The U.S. average price dropped to $3.01 in 1958, and to $2.94 in 1959. In January 1960, it was down slightly farther to about $2.93, with California postings lower than they averaged in 1959.

The drop of 7 cents per barrel in the U.S. average price in 1959 reflected lower prices in most areas, including the Mid-Continent, West Texas, Gulf Coast and California.

California prices down. As in 1958, the influx of natural gas to the West Coast had a marked affect on California prices last year. After starting 1959 averaging $2.95 per barrel, postings on Signal Hill 27-27.9 gravity crude oil dropped 21 cents to $2.74 per barrel on September 11.

On February 4, West Texas 30-30.9 gravity sour crude prices dropped to an average of $2.65 per barrel, followed by a lower posting of $2.97 per barrel for Oklahoma-Kansas crude on February 20.

Factors affecting prices. Three major changes are taking place in the traditional pricing systems:

- It is becoming increasingly difficult to isolate domestic crude prices from world prices. Price reductions in the Middle East and Venezuela put strong downward pressures on U.S. prices.
- With automatic control of gathering systems and pipe lines becoming the common practice, refiners are finding it more economical to carry smaller stocks of crude in storage, thus slowing down their purchases.
- With profit margins squeezed, refiners are becoming far more particular about the crudes they buy.

U. S. Average Prices of Crude Oil at Wells
Source: Bureau of Mines except 1960 est.

YEAR	($ Per Bbl.)	YEAR	($ Per Bbl.)	YEAR	($ Per Bbl.)
1918	1.98	1931	.65	1946	1.41
1919	2.01	1932	.87	1947	1.93
1920	3.07	1933	.67	1948	2.60
		1934	1.00	1949	2.54
1921	1.73	1935	.97	1950	2.51
1922	1.61				
1923	1.34	1936	1.09	1951	2.53
1924	1.43	1937	1.18	1952	2.53
1925	1.68	1938	1.13	1953	2.68
		1939	1.02	1954	2.78
1926	1.88	1940	1.02	1955	2.77
1927	1.30				
1928	1.17	1941	1.14	1956	2.79
1929	1.27	1942	1.19	1957	3.09
1930	1.19	1943	1.20	1958	3.01
		1944	1.21	1959	2.94
		1945	1.22	1960Jan.	2.93

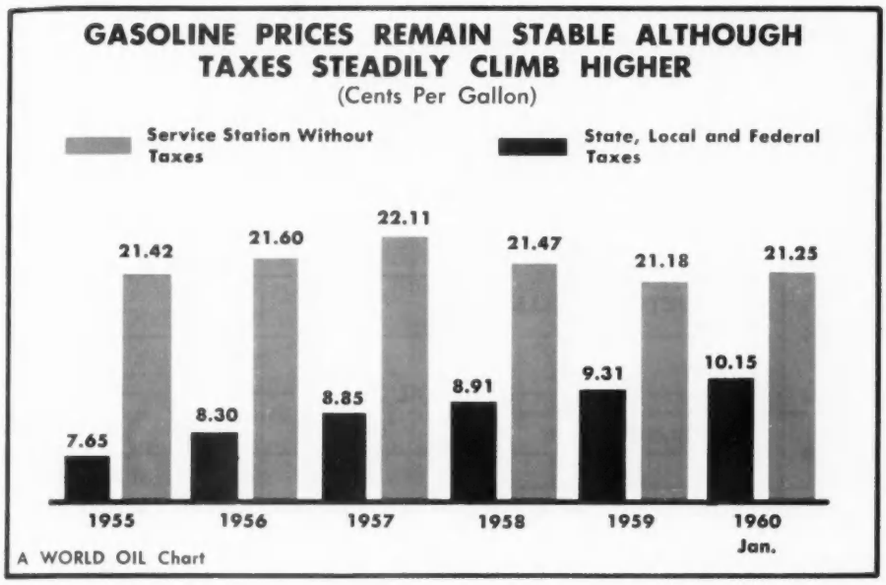
Crude Price Changes in Mid-Continent, California, and West Texas, by Years
(Dollars Per Barrel)

DATE	Okla., Kans. 36-36.9° Gravity	Calif., Long Beach 27-27.9°	West Texas Sour 30-30.9°
1937: Prior to Jan. 1	$1.10	$1.10	$0.78
January 28	1.22	....	0.88
1938: October 12	1.02	....	0.75
1939: No Changes	....	....	....
1940: February 1	....	1.03	....
1941: March 29	....	....	0.82
April 1	1.07	....	....
April 24	....	1.09	....
May 20	1.17	....	....
May 21	....	....	0.92
May 23	....	1.15	....
1942: Feb. 3; frozen at Oct. 1, 1941 level	1.17	1.15	0.92
1943 1944; 1945: No Changes; prices frozen	....	....	....
1946: April 1; OPA Raise	1.27	1.25	1.02
July 25: Oil Prices decontrolled	1.52	....	1.27
August 1	....	1.50	....
November 15	1.62	....	....
November 19	....	....	1.37
1947: March 10	1.87	....	1.62
March 19	....	1.75	....
July 1	....	1.95	....
October 15	2.07	....	....
October 16	....	....	1.82
December 6	2.57	....	2.32
December 27	....	2.45	....
1948: No Change	....	....	....
1949: June 1	....	2.37	....
1950: December 12	....	2.41	....
1951: Frozen at Jan. 25 level	2.57	2.41	2.32
1952: No Changes; frozen	....	....	....
1953: Feb. 16: decontrolled	....	2.76	....
June 15	2.82	....	2.57
1954: No Change	....	....	....
1955: No Change	....	....	....
1956: November 21	....	2.92	....
1957: January 3	3.07	....	2.82
January 17	....	3.17	....
1958: June 24	....	3.06	....
October 3	{2.93 / 3.00}	....	....
1959: January 26	....	2.95	....
February 4	....	....	2.65
February 20	2.97	....	....
September 11	....	2.74	....

Changes in Prices of Bradford, Pennsylvania, Crude, by Years
(Dollars Per Barrel)

Date	Price	Date	Price	Date	Price
1937: Before Jan. 1	$2.15	[3]1943:		[6]1951:	
Feb. 24	2.67				
June 7	2.82	[3]1944:		[6]1952:	
Sept. 1	2.60				
Oct. 12	2.35	[3]1945:		1953:	
Dec. 1	2.20			Feb. 16	4.40
		1946:		Aug. 1	4.55
1938:		[4]April 1	3.10	Sept. 21	4.05
Mar. 7	2.05	[5]Aug. 1	3.35		
June 13	1.80	Sept. 1	3.41	1954:	
Sept. 1	1.68	Dec. 9	3.55	Jan. 1	3.76
				May 20	3.26
1939:		1947:		Sept. 1	3.23
Jan. 21	1.80	Jan. 1	3.65	Dec. 1	3.35
Feb. 1	1.88	Mar. 1	3.81		
Mar. 6	2.00	April 1	3.91	1955:	
Oct. 6	2.25	May 16	4.05	Jan. 21	3.50
Nov. 1	2.40	July 1	4.30	July 11	3.60
Dec. 1	2.50	Sept. 1	4.50	Nov. 1	3.75
		Dec. 1	5.00	Dec. 1	3.85
1940:		1948:		1956:	
Jan 1	2.75	Dec. 11	4.50	Feb. 6	4.00
May 22	2.50			Mar. 16	4.20
June 18	2.25	1949:		May 16	4.45
July 12	2.00	Jan. 21	4.00	July 16	4.57
Aug. 18	1.85	Mar. 11	3.75	Aug. 16	4.68
Nov. 12	2.00	April 1	3.55		
Dec. 17	2.15	April 13	3.40	1957:	
		May 11	3.27	Jan. 16	4.88
1941:		June 16	3.40	July 26	4.65
Jan. 27	2.30	Dec. 12	3.54		
April 23	2.40			1958:	
May 20	2.55	1950:		Feb. 3	4.40
June 18	2.75	May 1	3.65	Apr. 16	4.15
Aug. 14	2.98	June 21	3.75	June 18	3.90
Aug. 23	2.75	July 19	3.89	Dec. 22	4.05
		Aug. 25	4.00		
1942:		Oct. 9	4.10	1959:	
[1]Feb. 3	2.75	Dec. 9	4.25	Apr. 1	4.15
[2]Mar. 26	3.00			May. 1	4.25
				Sept. 12	4.40

[1] Frozen at Oct. 1, 1941 level. [2] Penn. grade raise granted. [3] No change; price frozen. [4] Raise granted by OPA. [5] Oil prices decontrolled July 25, 1946. [6] No change; price frozen at Jan. 25, 1951, level.



Gasoline prices dip lower

GASOLINE PRICES at the pump continue to reflect the trend of recent years:

Retail prices remain stable. According to January 1960 estimates, retail gasoline prices averaged 21.25 cents per gallon, while the 1959 average was 21.18 cents—the lowest price levels since 1952.

Taxes increase annually. As a result of the 1-cent hike in federal taxes last October (the ninth increase in as many years), state, local and federal taxes during January 1960 were up 1.24 cents over the 1958 average of 8.91 cents per gallon.

U. S. Average Prices of Gasoline in 50 Cities, by Years

(Cents Per Gallon . . . API Data)

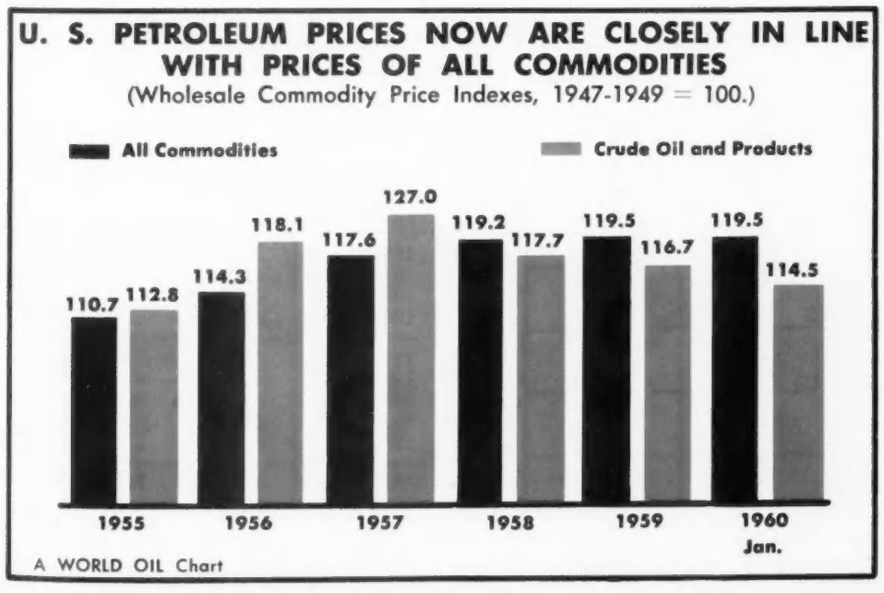
YEAR	Dealer's Net	Service Sta. Excl. Tax	State and Local Tax	Federal Tax	Service Sta. Incl. Tax
1918	.....	25.12	0.00	....	25.12
1919	.....	25.41	0.06	....	25.47
1920	.....	29.74	0.09	....	29.83
1921	.....	26.11	0.20	....	26.31
1922	.....	24.82	0.38	....	25.20
1923	.....	21.06	0.91	....	21.97
1924	.....	19.46	1.48	....	20.94
1925	.....	20.09	2.11	....	22.20
1926	17.44	20.97	2.41	....	23.38
1927	15.00	18.29	2.80	....	21.09
1928	14.83	17.90	3.00	....	20.94
1929	14.58	17.92	3.50	....	21.42
1930	12.48	16.17	3.78	....	19.95
1931	9.65	12.98	4.00	....	16.98
1932	10.08	13.30	4.13	0.50	17.93
1933	9.42	12.41	4.16	1.25	17.82
1934	9.81	13.64	4.21	1.00	18.85
1935	9.73	13.55	4.29	1.00	18.84
1936	10.21	14.10	4.35	1.00	19.45
1937	10.53	14.59	4.40	1.00	19.99
1938	10.04	14.07	4.44	1.00	19.51
1939	9.58	13.31	4.44	1.00	18.75
1940	9.08	12.75	4.41	1.25	18.41
1941	9.49	13.30	4.43	1.50	19.23
1942	10.44	14.46	4.47	1.50	20.43
1943	10.45	14.56	4.47	1.50	20.53
1944	10.49	14.62	4.47	1.50	20.59
1945	10.33	14.48	4.52	1.50	20.50
1946	10.40	14.69	4.58	1.50	20.77
1947	12.33	16.93	4.68	1.50	23.11
1948	14.55	19.54	4.84	1.50	25.88
1949	15.05	20.27	5.02	1.50	26.79
1950	15.10	20.08	5.18	1.50	26.76
1951	15.33	20.31	5.25	1.59	27.15
1952	15.27	20.24	5.32	2.00	27.56
1953	15.95	21.28	5.41	2.00	28.69
1954	16.19	21.56	5.39	2.00	28.95
1955	16.18	21.42	5.65	2.00	29.07
1956	16.33	21.60	5.80	2.50	29.90
1957	16.69	22.11	5.85	3.00	30.96
1958	16.22	21.47	5.91	3.00	30.38
1959 Est.	16.10	21.18	6.06	3.25	30.49
1960 Jan.	16.25	21.25	6.15	4.00	31.40

Oil price index continues downward trend

THE WHOLESALE PRICE index of crude oil and products was estimated at 114.5 percent of the 1947-49 level in late January, continuing a steady decline that started in 1958.

While the index for all oils has been dropping, wholesale prices of all commodities have remained consistently higher, averaging above 119 during the three-year period.

Oil prices are expected to remain stable or improve during 1960.



Index of Wholesale Prices

(All Commodities vs. Crude Petroleum and Petroleum Products.)

Source: U. S. Bureau of Labor Statistics. 1947-1949 = 100

Year	All Commodities	Crude Oil & Products	Year	All Commodities	Crude Oil	Pet. Products	Crude Oil & Products
1926	65.0	98.1	1944	67.6	.....	.....	62.7
1927	62.0	71.3	1945	68.8	.....	.....	62.3
1928	62.9	70.6					
1929	61.9	69.9	1946	78.7	.....	.....	66.3
1930	56.1	60.4	1947	96.4	81.6	89.6	88.2
			1948	104.4	109.9	112.1	111.7
1931	47.4	38.7	1949	99.2	108.5	98.3	100.1
1932	42.1	44.5	1950	103.1	108.4	102.8	103.7
1933	42.8	40.2					
1934	48.7	49.5	1951	114.8	109.0	110.1	110.5
1935	52.0	50.3	1952	111.6	109.0	109.2	109.3
			1953	110.0	117.0	111.9	112.7
1936	52.5	56.2	1954	110.3	120.3	109.4	110.8
1937	56.1	59.3	1955	110.7	120.5	111.2	112.7
1938	51.1	54.9					
1939	50.1	51.3	1956	114.3	121.1	117.5	118.2
1940	51.1	49.1	1957	117.6	133.6	126.7	127.0
			1958	119.2	133.8	.....	117.7
1941	56.8	56.0	1959	119.5	129.5	.....	116.7
1942	64.2	58.7	1960				
1943	67.0	61.4	Jan.	119.5	128.5	.....	114.5

Productive completions to continue rise

THE 1.4 PERCENT increase in drilling activity forecast by WORLD OIL for the United States during 1960 (see Page 84) will be accompanied by a 0.4 percent rise in the total number of new producing wells completed, it is anticipated.

The expected drilling activity points to the completion this year of 29,086 new productive wells, consisting of 24,045 new oil wells and 5,041 new gas and distillate wells. In 1959, there were 28,974 productive wells completed, including 24,043 new oil wells and 4,931 new gas and distillate producing wells.

Although the expected 0.4 percent increase in the number of new producing wells in 1960 is marginal, it continues the upturn which began in 1959 after two years of decreases. The year 1957 recorded a sharp decrease in activity, which resulted in 31,839 new producing wells, and 1958 reflected a 6.6 percent decline. The years 1957 and 1958 are the only ones since World War II in which the drilling industry has failed to register increases.

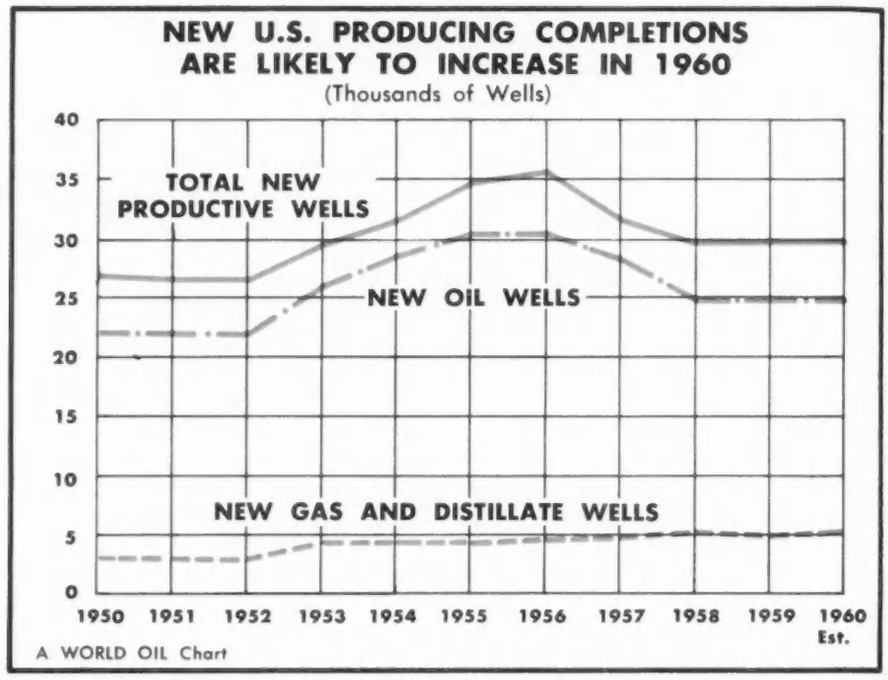
Even though the United States still has the ability to produce significantly more oil than required by demand, the outlook for 1960 is an improved one.

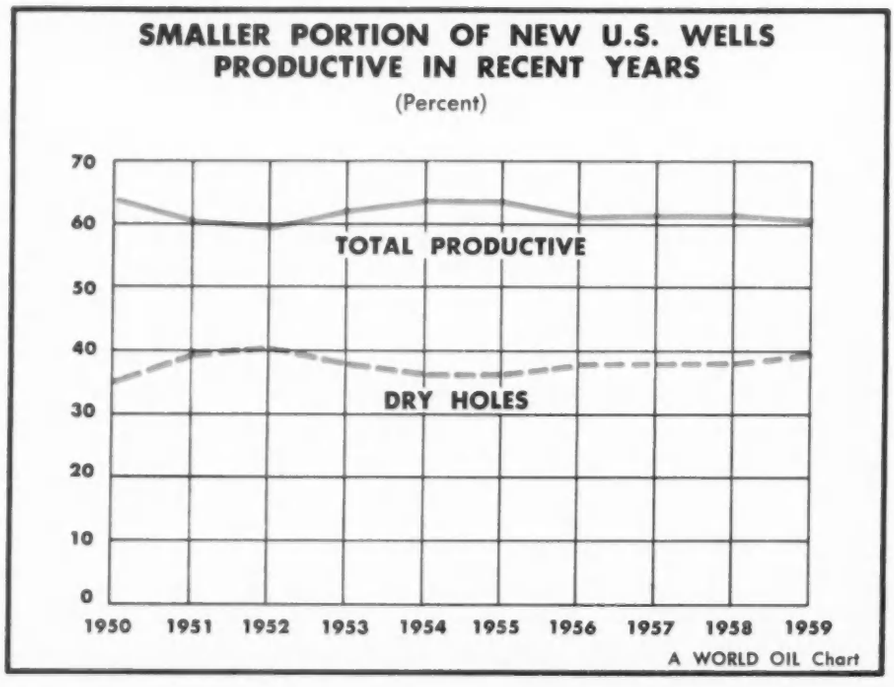
Continued progress in general business activity, anticipated by some circles to reach record levels this year, together with extremely cold weather in the United States during the early part of 1960, are two factors which support the outlook for an increase in oil demand during 1960 and for improved conditions in the oil industry during the current year.

Increased consumption, continued progress in improving U. S. Inventories, and an expected firming of the market for oil are seen as influencing production rates. With larger production rates, more income for producers is presaged—a major factor in determining drilling activity.

For the ninth consecutive year, the percent of the wells drilled which found oil, gas or distillate ranged near the 62 percent level. The decrease in percent of wells drilled which discover production occurred equally in oil wells and gas and distillate wells. Previously, the trend found most of the decrease in percent of wells drilled which discover production occurring in oil wells.

During the 1937-1941 period, 68 percent of the wells drilled produced oil. This level has declined over the





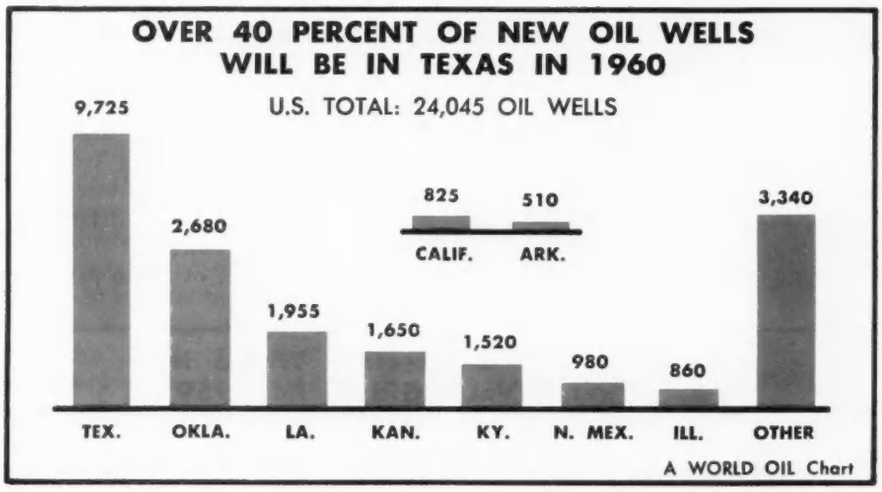
Percent of U. S. Wells Drilled in Search of Production Which Were Productive

	Oil Wells	Gas and Distillate Wells	Dry Holes
1937-1941	68.0	8.5	23.5
1942-1946	56.1	13.1	30.8
1947	56.7	11.9	31.4
1948	59.3	8.8	31.9
1949	56.6	9.3	34.1
1950	56.4	8.2	35.4
1951	52.8	7.9	39.3
1952	51.6	8.2	40.2
1953	52.3	8.8	38.9
1954	54.6	8.2	37.2
1955	55.2	7.6	37.2
1956	53.4	7.8	38.8
1957	52.5	8.8	38.7
1958	50.7	10.6	38.6
1959	50.5	10.4	39.1

years, reaching a low of 50.5 percent in 1959. The declining trend has been particularly evident during the past four years (see accompanying table).

Again, in 1960, Texas—with 11,325—will lead in new producing completions by a wide margin, due to its larger drilling activity, followed by Oklahoma, with 3,210 wells; Louisiana, with 2,500; Kansas, with 1,840 wells; and Kentucky, with 1,785 total productive wells.

Of the Texas forecast, Districts 7-C and 8 (West Texas) are expected to record the largest number of total productive wells in the state—3,710 wells.



Forecast of New U.S. Productive Well Completions in 1960

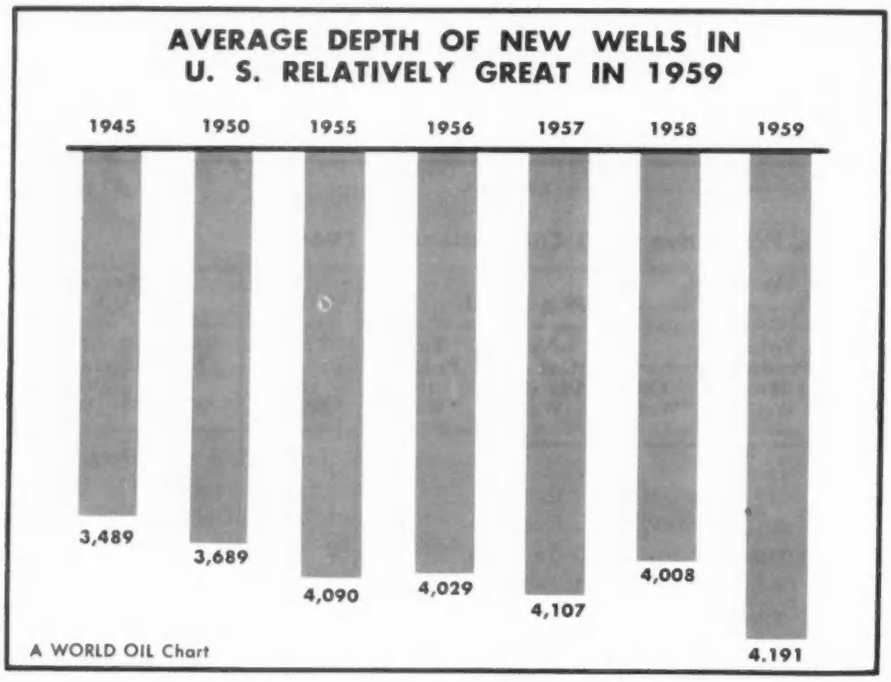
STATE or DISTRICT	1960 FORECAST			1959 ACTUAL			% DIFF.	1960 Percent of U.S.	
	New Oil Wells	New Gas and Distillate Wells	Total Productive Wells	New Oil Wells	New Gas and Distillate Wells	Total Productive Wells	Total Productive Wells	New Oil Wells	New Gas and Distillate Wells
Alabama	55	.....	**55**	75	.....	75	— 26.7	0.2	.....
Alaska	5	3	**8**	4	3	7	+ 14.3	.....	.....
Arizona	2	1	**3**	2	1	3	.....	.....	.....
Arkansas	510	50	**560**	448	44	492	+ 13.8	2.1	1.0
California	825	70	**895**	859	82	941	— 4.9	3.4	1.4
Colorado	155	75	**230**	138	77	215	+ 7.0	0.7	1.5
Illinois	860	15	**875**	963	18	981	— 10.8	3.6	0.3
Indiana	270	10	**280**	280	11	291	— 3.8	1.1	0.2
Kansas	1,650	190	**1,840**	1,664	187	1,851	— 0.6	6.9	3.8
Kentucky	1,520	265	**1,785**	1,565	272	1,837	— 2.8	6.3	5.3
Louisiana	1,955	545	**2,500**	1,805	536	2,341	+ 6.8	8.1	10.8
North Louisiana	855	155	**1,010**	772	162	934	+ 8.1	3.6	3.1
South Louisiana	1,100	390	**1,490**	1,033	374	1,407	+ 5.9	4.5	7.7
Gulf of Mexico[1]	355	75	**430**	288	61	349	+ 23.2	1.5	1.5
Michigan	330	90	**420**	239	70	309	+ 35.9	1.4	1.8
Mississippi	250	40	**290**	257	42	299	— 3.0	1.1	0.8
Missouri	1	.....	**1**	1	.....	1	.....	.....	.....
Montana	195	10	**205**	151	9	160	+ 28.1	0.8	0.2
Nebraska	250	.....	**250**	268	1	269	— 7.1	1.0	.....
New Mexico	980	290	**1,270**	1,096	328	1,424	— 10.8	4.1	5.8
Southeast	660	25	**685**	729	28	757	— 9.5	2.8	0.5
Northwest	320	265	**585**	367	300	667	— 12.3	1.3	5.3
New York	140	15	**155**	145	20	165	— 6.1	0.6	0.3
North Dakota	225	.....	**225**	259	.....	259	— 13.1	0.9	.....
Ohio	480	280	**760**	498	292	790	— 3.8	2.0	5.6
Oklahoma	2,680	530	**3,210**	2,619	528	3,147	+ 2.0	11.2	10.5
Pennsylvania	205	335	**540**	195	315	510	+ 5.9	0.8	6.6
South Dakota	15	.....	**15**	11	.....	11	+ 36.4	0.1	.....
Tennessee	70	5	**75**	5	1	6	+1,150.0	0.3	0.1
Texas	9,725	1,600	**11,325**	9,816	1,511	11,327	.....	40.5	31.7
Dist. 1: South Central	620	55	**675**	528	43	571	+ 18.2	2.6	1.1
Dist. 2: Middle Gulf	225	230	**455**	207	222	429	+ 6.1	0.9	4.5
Dist. 3: Upper Gulf	550	245	**795**	497	222	719	+ 10.6	2.3	4.9
Dist. 4: Lower Gulf-S.W.	420	330	**750**	413	326	739	+ 1.5	1.8	6.5
Dist. 5 & 6: East	635	140	**775**	497	109	606	+ 27.9	2.6	2.8
Dist. 7-B & 9: North	2,885	225	**3,110**	3,026	219	3,245	— 4.2	12.0	4.5
Dist. 7-C & 8: West	3,600	110	**3,710**	3,906	120	4,026	— 7.8	15.0	2.2
Dist. 10: Panhandle	790	265	**1,055**	742	250	992	+ 6.4	3.3	5.2
Utah	145	20	**165**	162	18	180	— 8.3	0.6	0.4
West Virginia	155	535	**690**	147	502	649	+ 6.3	0.6	10.6
Wyoming	390	65	**455**	369	61	430	+ 5.8	1.6	1.3
Other States*	2	2	**4**	2	2	4	.....	.....	.....
Total U.S.	24,045	5,041	**29,086**	24,043	4,931	28,974	+ 0.4	100.0	100.0

[1] Gulf of Mexico wells are included in South Louisiana figures.
* Other States include Florida, Maryland, Nevada, Virginia and Washington.

Average U.S. well depth sets new record

THE AVERAGE drilling depth in the United States increased sharply last year, following a slump in costly deep drilling during the recession year of 1958.

Drilling of 202.5 million feet of hole in completing 48,328 wells resulted in an average depth of 4,191 feet per new completion. This represented a substantial increase of 183 feet per well over 1958. Also, the 1959 average was up 84 feet over the previous average depth record of 4,107 feet per well in 1957.



In comparison, U.S. well depths averaged only 3,689 feet in 1950 and 3,463 feet in 1948.

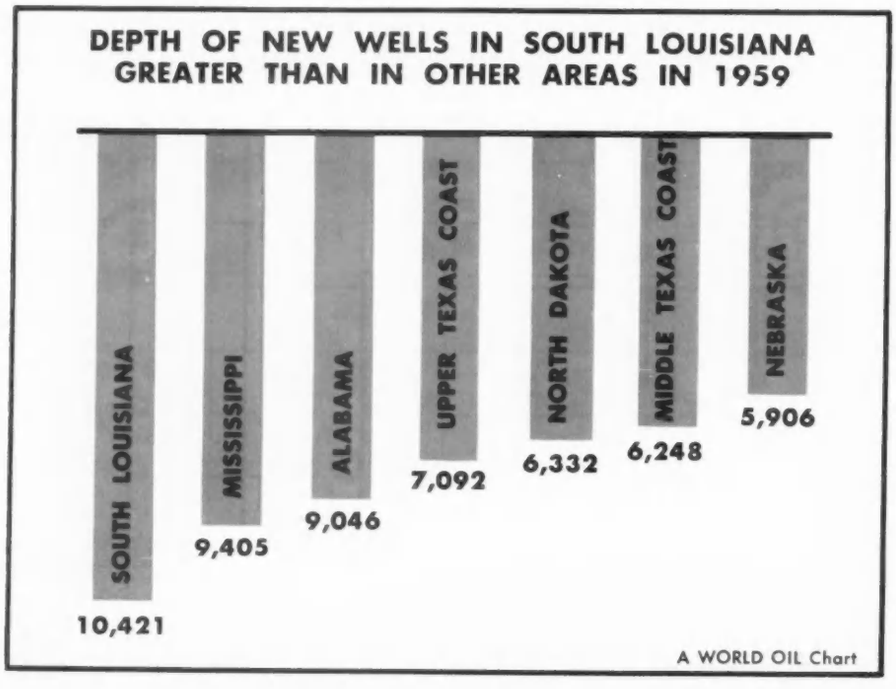
Factors contributing to the new record average depth included:

- Greater concentration of exploratory drilling in areas involving deeper objective horizons, i.e., South Louisiana, Texas Gulf Coast and West Texas.
- Increased development and wildcat drilling in regions with above-national-average depths.

Of the 48,328 new wells drilled last year, 27,739 were producers with an average depth of 4,138 feet per well —110 feet deeper than the average five years ago. There were 18,589 dry holes averaging 4,214 feet—210 feet deeper than the per-well average depth in 1954.

The 24,043 oil wells completed last year averaged 3,935 feet per well; 4,131 gas wells averaged 4,530 feet, and 800 distillate wells averaged 9,864 feet. The 865 service wells averaged 2,399 feet in depth.

South Louisiana is area of deepest drilling



THE DEEP drilling areas of the U.S. continued their trend to deeper per-well depths during 1959.

South Louisiana increased its depth average 88 feet to 10,421 feet per well in completing 2,450 new wells. Mississippi's 655 wells averaged 9,405 feet in depth, up 898 feet over 1958, and Alabama increased its depth average 973 feet to 9,046 feet for 85 wells drilled.

The Upper Texas Coast moved from fifth to fourth among the deepest drilling areas with a per-well depth average of 7,092 feet for 1,315 new wells drilled, up 632 feet over the previous year.

Other deep areas not listed include Alaska, where 14 wells were drilled averaging 10,119 feet per well; South Dakota with 23 wells averaging 7,320 feet, and Washington with 4 wells averaging 7,982 feet.

Drilling depth records set in five U.S. areas in 1959

THE U. S. DRILLING depth record remained unchanged during 1959. In fact, no wells were drilled below 20,000 feet.

Also, fewer areas reported new depth records than in recent years. WORLD OIL surveys of oil companies and state agencies reveal that only five new depth records were set in the nation's 46 drilling areas. In comparison, nine records were broken in 1958 and 10 in 1957.

The deepest well drilled during 1959 was Shell Oil Company's William M. Carroll 1, wildcat 16 miles east-northeast of Cuero in Dewitt County, Southwest Texas. The well reached a total depth in the Edwards limestone at 19,765 feet. The previous record holder in Southwest Texas was Ginther, Warren and Ginther et al's Killam 1-A wildcat in Webb County, drilled to 19,503 feet in 1958.

In North Dakota, Amerada Petroleum Corporation's Antelope Unit 1-A in McKenzie County reached total depth of 15,135 feet at the end of 1959, breaking the record set by Amerada's 14,828-foot North Dakota Unit A-9 in the Beaver Lodge-Tioga field, Williams County, in 1957.

Alaska's one-year-old depth record was broken in 1959 by the Union Oil-Ohio Oil Kenai Unit 1, which was drilled to 15,047 feet. In 1958, Standard Oil Company of California et al's Deep Creek Unit 1 on the South Kenai Peninsula set the previous record at 14,221 feet.

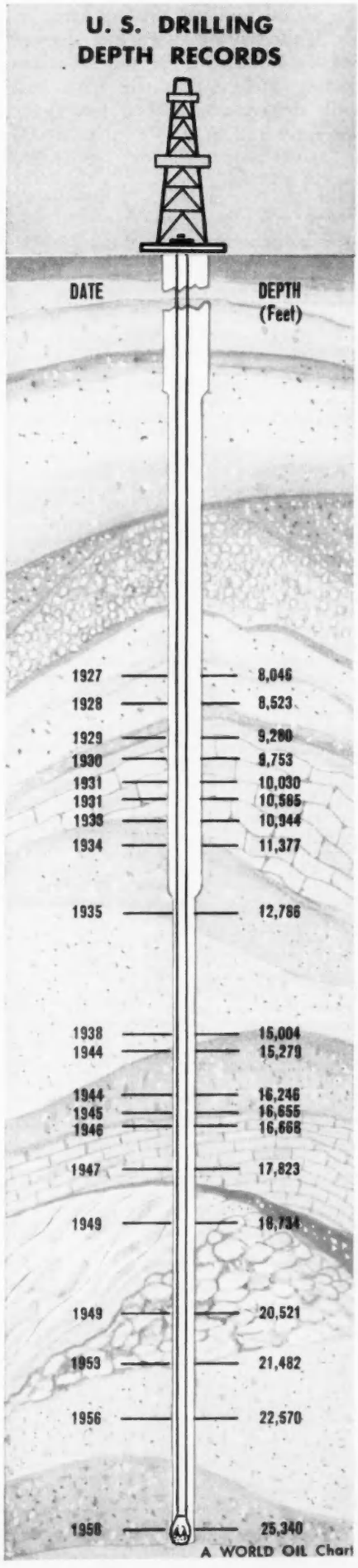
In Kentucky, United Fuel Gas Company's James 1, Martin County, was drilled to 13,170 feet, erasing the record of 11,130 feet set in 1958 by United Fuel Gas Company's S. B. Williams 8613 in Breathitt County.

The fifth new depth record was set in Indiana, where the Indiana Farm Bureau's Luther Brown well in Lawrence County was drilled to 6,806 feet. The well broke a 13-year record held by Continental Oil Company's 6,408-foot Cooper 1-D in Gibson County's Griffin field.

Greater depth areas increase. Thirty-two, or nearly 70 percent, of

Holders of Record as Deepest Test Drilled
(Includes Both Dry and Producing Wells)

Year	Company, Well and Location	Feet
1927	Chansler-Canfield-Midway Oil Co.'s Olinda 96, Olinda, California	8,046
1928	Texon Oil and Land Co.'s University 1-B, Big Lake, West Texas	8,523
1929	Shell Oil Co.'s Nesa 1, Long Beach, California	9,280
1930	Standard Oil Company of California's Mascot 1, Midway, California	9,753
1931	Chansler-Canfield-Midway Oil Co.'s Hobson A-2, Rincon field, Ventura County, Calif.	10,030
1931	Penn-Mex Fuel Co.'s Jardin 35, State of Vera Cruz, Mexico	10,585
1933	North Kettleman O. & G. Co.'s (later Union Oil's Lillis-Welch 1) Kettleman Hills, Calif.	10,944
1934	General Petroleum Corp.'s Berry 1, Belridge, Kern County, California	11,377
1935	Gulf Oil Corp.'s McElroy 103, Gulf-McElroy, Upton County, W. Texas	12,786
1938	Continental Oil Co.'s KCL A-2, Wasco, Kern County, California	15,004
1944	Phillips Petroleum Co.'s Price 1, Wildcat, Pecos County, West Texas	15,279
1944	Standard Oil Co. of California's KCL 20-13, South Coles Levee, Kern County, California	16,246
1945	Phillips Petroleum Co.'s Schoeps 3, Wildcat, Brazos County, Gulf Coast, Texas	16,655
1946	Pacific Western Oil Corp.'s National Royalties 1, Miramonte area, Kern County, Calif.	16,668
1947	Superior Oil Company of California's Weller 51-11, Wildcat, Caddo County, Okla.	17,823
1949	Superior Oil Company of California's Limoneria 1, Wildcat, Ventura County, Calif.	18,734
1949	Superior Oil Company of California's Unit 1, Wildcat, Sublette County, Wyoming	20,521
1953	Ohio Oil Co.'s Kern County Lands "A" 72-4, Paloma field, Kern Co., California	21,482
1956	Richardson & Bass, Freeport Sulphur & J. W. Mecom's Humble-L.L.&E. 1-L, Plaquemines, S. Louisiana	22,570
1958	Phillips Petroleum's University EE-1, Wildcat, Pecos County, West Texas	25,340



the 46 oil and gas drilling areas in the United States have had drilling below 10,000 feet. Of the areas reporting such depths, six have had wells drilled over 20,000 feet deep, two have had wells as deep as 19,000 to 20,000 feet, one as deep as 18,000 feet, while two areas have had 17,000 to 18,000-foot wells.

There are two areas reporting 16,000 to 17,000-foot wells; four with 15,000-16,000-foot wells, one 14,000 feet; six 13,000-14,000 feet; four 12,000-13,000 feet; three 11,000-12,000 feet, and one 10,000 feet. Ten years ago, the first well was drilled below 20,000 feet. It was Superior Oil Company's Unit 1 in Sublette Coutny, Wyoming. The 20,521-foot well still holds the depth record in Wyoming.

Regional Drilling Depth Records in United States

State or District	Total Depth	Year	WELL AND LOCATION	Formation
West Texas	**25,340**	1958	Phillips Pet. Co's University EE-1, wildcat, Pecos County	Ellenburger
Oklahoma	**24,014**	1958	Shell's Rumberger 5, Elk City field, Becham County	Springer-Pennsylvanian
S. La.-Inshore	**22,570**	1956	Richardson & Bass et al's Humble-LL&E 1-L, Plaquemines Parish	Miocene
California	**21,482**	1955	Ohio Oil's KCL "A" 72-4, Paloma field, Kern County	L. Miocene
Wyoming	**20,521**	1949	Superior of Calif.'s Unit 1, Pacific Creek area, Sublette County	U. Cretaceous
Mississippi	**20,450**	1956	George Vasen et al's Fee 1, 9-2s-11w, Stone County (Salt, Jurassic)	Eagle Mills
Southwest Texas	**19,765**	1959	Shell's Wm. M. Carroll 1, DeWitt County, wildcat, 16 mine Cuero	Edwards
Texas Gulf Coast	**19,056**	1955	Socony Mobil's West Ranch 417-A, West Ranch field, Jackson County	Cockfield
S. La.-Offshore	**18,002**	1957	Hunt Oil's No. 2 State Lease 758, blk 39, Coon Point field, Ship Shoal area	Miocene
N. Mex S.E.	**17,555**	1958	Shell's James Ranch Unit 1, wildcat, Eddy County	Ellenburger
Colorado	**17,033**	1957	Phillips Petroleum's Mannel 1, 26-1n-95w, Rio Blanco County	Weber
East Texas	**16,347**	1949	Humble's R.P. McWatters 1, Freestone County	Jurassic
N. Tex. & P'handle	**16,156**	1958	Max Pray's Mills 1, Wheeler County	Bend Cong.
Alabama	**15,729**	1952	Humble's Emma Williams 1, 10-3n-2e, Clarke County	Jurassic
Florida	**15,455**	1947	Gulf's State of Florida, 1, Big Pine Key area, Monroe County	L. Cretaceous
North Dakota	**15,135**	1959	Amerada's Antelope Unit 1-A, 1-152n-95w, McKenzie Co. Testing at end 1959	Cambrian
Alaska	**15,047**	1959	Union & Ohio's Union-Ohio Kenai Unit 1, 6-4n-11w	.....
North La.	**14,967**	1947	Cotton Valley Opr. Comm. et al's A.G. Oliphant Banks 2, Webster Parish	Salt
Montana	**13,830**	1956	Phillip's Northern Pacific RR 1-A, 33-9s-21e, Carbon County	Madison
Utah	**13,766**	1949	Pacific Western Oil & Equity Oil's Unit 1, 33-21s-21e, Grand County	Pennsylvanian
N. Mex. N.W.	**13,590**	1956	Magnolia's Jicarilla 1-A, 18-23n-2w, Rio Arriba County	Granite
New York	**13,500**	1958	New York State Nat. Gas' Woodhull Twp., Steuben County	Sub-Potsdam
West Virginia	**13,331**	1955	Hope Natural Gas Co.'s Power Oil Co. 9634, Walker dist. Wood County	Pre-Cambrian
Kentucky	**13,170**	1959	United Fuel Gas Co.'s James 1, Martin County	.....
Arkansas	**12,925**	1957	Hunt Oil's R.B. McDonald, 1-20s-21w, Columbia County	Salt
Oregon	**12,880**	1956	Sinclair's Federal-Mapleton 1, 12-16s-10w, Lane County	Eocene
Idaho	**12,844**	1951	Phillips & Utah Southern's Unit 1, 10-14s-30e, Oneida County	.....
Pennsylvania	**12,343**	1951	California Co.'s Bennett 1, Davidson Twp., Sullivan County	Ordovician
Nevada	**11,543**	1952	Continental & Standard's Summit Springs Unit 1, 32-20n-60e, White Pine Co.	Mississippian
Michigan	**11,012**	1948	Ohio Oil-Pure Oil's Reinhardt 1, West Branch field, Ogemaw County	Cambro-Ord.
Washington	**11,002**	1947	Standard of Calif.'s Alderwood Comm. 1 Snohomish County	Mid. Eocene
North Carolina	**10,054**	1946	Standard of New Jersey's Cape Hatteras 1, Dare County	Granite
Virginia	**9,936**	1949	The California Co.'s Kipps Anthracite Coal Co. 1, Montgomery County	Ordovician
South Dakota	**9,348**	1951	Shell Oil Co.'s J.T. Homme 1, 13-20n-12e, Perkins County	Eocene
Nebraska	**8,875**	1957	Shell's Schnieder 2, 26-15n-56w, Heidemann field, Kimball County	Pre-Cambrian
Kansas	**8,243**	1947	Pan American's (Stanolind's) Feathers 1, 15-35s-33w, Seward County	.....
Maryland	**8,165**	1941	William Snee's Schartzer 1, Accident Dist., Gerrett County	Helderburg
Ohio	**7,889**	1933	Benedum & Tree's Knowlton 1, Independence Twp., Washington County	Clinton
Illinois	**7,682**	1952	Superior Oil Co.'s H.C. Ford et al C-17, 27-4s-14w, White County	Shakopee
Georgia	**7,613**	1958	J.R. Sealy's Lena Rebecca Sealy 3, Seminole County	L. Cretaceous
Arizona	**7,568**	....	Arizona Oil & Gas Co.'s State 1, Cochise County	Pennsylvanian
Indiana	**6,806**	1959	Indiana Farm Bureau's Luther Brown 1, 20-5n-2e, Lawrence County	Granite
Tennessee	**5,750**	1947	The California Co,'s E.W. Beeler 1, 4-15s-29e, Giles County	Granite
Iowa	**5,305**	1930	Oil Development Co.'s Wilson 1, Page County	Cambrian
New Jersey	**5,022**	1928	W&K Oil Co.'s Well 1, Jackson Mills area, Ocean County	Granite
Missouri	**4,740**	1941	Strake Petroleum Co.'s T.P. Russell 1, Pemiscot County	Cambrian

U. S. drilling rig activity up 1.6 percent

THE AVERAGE NUMBER of U.S. drilling rigs operating monthly increased slightly (1.6 percent) during 1959. However, the average still was far below the record of any post war year except 1958.

In short, drilling rig activity fell far short of the gains that were expected during a recovery year, following a recession.

Last year's 4,178-rig average was up 64 rigs per month over 1958, but down 613 rigs from the 4,791 operated monthly during 1957, and 667 less than the 4,845-rig average reported in 1956.

Rig activity increased only moderately during the first half of the year, reaching a peak of 4,339 rigs operating on June 30, then started a steady month-end decline which continued through December.

Of the 23 major drilling states (25 rigs or more), only 6 had more rigs operating at the end of 1959 than at the close of 1958. They included Illinois, up 50 rigs to 324; Kentucky, up 85 rigs to 180; Michigan, up 29 rigs to 115; Mississippi, up 2 rigs to 77; Montana, up 3 rigs to 42; and New Mexico, up 19 rigs to 173.

Illinois and Kentucky also recorded the highest average monthly drilling rig increases during the year, with a 329-rig monthly average in Illinois, up 52 rigs per month over 1958, and 168 rigs in Kentucky, up an average of 66 rigs per month.

Texas averaged 1,033 rigs operating per month, up 22 rigs over 1958. However, the 971 rigs operating in the State on December 31 reflected a drop of 210 rigs from the same date in 1958.

Average Number of U.S. Drilling Rigs in Operation, by States, 1958 and 1959

(Note: For data at end of each month, by states, see regular issues of WORLD OIL.)

State or District	1959	1958	State or District	1959	1958
Alabama	**11**	**13**	**Pennsylvania**	**169**	**197**
Alaska	**5**	.....	**South Dakota**	**3**	**2**
Arkansas	**45**	**46**	**Tennessee**	**25**	.....
California	**138**	**139**	**Texas**	**1,033**	**1,011**
Colorado	**55**	**57**			
Illinois	**329**	**277**	Dist. 1: South Central	38	35
Indiana	**89**	**103**	Dist. 2: Middle Gulf	53	36
Kansas	**293**	**321**	Dist. 3: Upper Gulf	94	85
Kentucky	**168**	**102**	*Gulf of Mexico	1	2
Louisiana	**351**	**338**	Dist. 4: L. Gulf-S.W.	81	64
			*Gulf of Mexico	.....	1
North Louisiana	62	68	Dist. 5: East Central	12	11
South Louisiana	289	272	Dist. 6: Northeast	54	58
*Gulf of Mexico	53	46	Dist. 7-B: N. Central	98	84
			Dist. 7-C: W. Central	68	65
Michigan	**93**	**72**	Dist. 8: West	287	314
Mississippi	**74**	**50**	Dist. 9: North	157	164
Missouri	**2**	**1**	Dist. 10: Panhandle	92	94
Montana	**44**	**39**			
Nebraska	**35**	**32**	**Utah**	**39**	**42**
Nevada	.....	.....	**Washington**	**1**	**1**
New Mexico	**167**	**168**	**West Virginia**	**202**	**209**
New York	**25**	**42**	**Wyoming**	**95**	**84**
North Dakota	**35**	**37**	**Others**	**14**	**7**
Ohio	**211**	**222**			
Oklahoma	**472**	**500**	**Total, U.S.**	**4,178**	**4,114**

*** State district data include offshore operations.**

Drilling Rigs in Use in United States, by Years, by Months

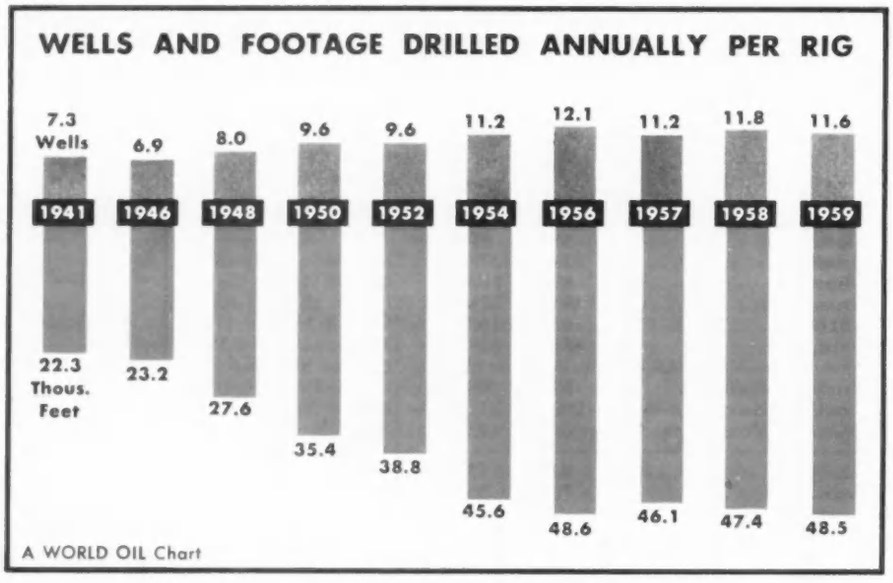
Figures are for end of month, and include rigs drilling, rigging up, and shut down

YEAR	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Avg. for Year
1938	3,968	3,928	3,973	3,971	3,582	4,830	3,737	3,869	3.742	3,876	3,676	3,434	3,799
1939	3,583	3,391	3,448	3,630	3,695	3,726	3,567	3,718	3,625	3,905	3,981	3,924	3,683
1940	3,990	4,277	4,472	4,327	4,655	4,502	4,235	4,194	3,821	3,921	4,030	3,894	4,193
1941	3,814	3,952	4,121	4,287	4,335	4,598	4,819	4,984	4,693	4,672	4,746	4,336	4,446
1942	3,816	3,067	2,979	2,859	2,868	2,905	3,179	3,007	2,953	3,094	2,962	2,797	3,041
1943	2,691	2,653	2,732	2,756	2,743	2,852	3,015	3,201	3,031	3,548	3,676	3,595	3,041
1944	3,427	3,568	3,702	3,819	3,934	4,278	4,411	4,528	4,566	4,738	4,665	4,640	4,190
1945	4,270	4,154	4,159	4,374	4,637	4,394	4,424	4,289	4,356	4,521	4,426	4,637	4,387
1946	4,337	4,229	4,212	4,405	4,399	4,124	4,235	4,201	4,474	4,410	4,551	4,654	4,353
1947	4,390	4,402	4,379	4,470	4,603	4,802	4,992	5,163	4,979	4,897	4,871	4,945	4,741
1948	4,699	4,542	4,626	4,989	5,067	5,090	5,013	5,058	5,116	5,229	5,060	4,908	4,950
1949	4,511	4,490	4,368	4,265	4,276	4,097	4,015	4,118	4,258	4,247	4,485	4,355	4,290
1950	4,180	4,169	4,114	4,224	4,518	4,760	4,712	4,804	4,633	4,773	4,649	4,665	4,517
1951	4,275	4,339	4,435	4,600	4,831	4,762	4,989	4,988	5,237	5,260	5,234	5,182	4,844
1952	5,010	5,015	5,092	5,093	5,151	5,037	4,694	4,508	4,687	4,659	4,689	4,649	4,857
1953	4,585	4,585	4,611	4,661	4,693	4,935	4,878	4,997	4,879	4,939	5,047	4,802	4,784
1954	4,597	4,743	4,732	4,709	4,716	4,656	4,616	4,439	4,467	4,581	4,685	4,680	4,635
1955	4,502	4,456	4,683	4,713	4,816	4,997	4,965	5,019	4,987	5,124	5,160	4,987	4,867
1956	4,597	4,677	4,883	4,886	5,019	5,019	4,775	4,819	4,828	4,865	4,882	4,885	4,845
1957	4,625	4,582	4,621	4,749	4,868	4,930	4,983	4,945	4,887	4,844	4,889	4,569	4,791
1958	4,153	3,936	3,813	3,959	3,946	3,970	4,082	4,201	4,118	4,338	4,410	4,445	4,114
1959	3,997	3,855	4,119	4,143	4,285	4,399	4,317	4,302	4,252	4,193	4,183	4,094	4,178

Penetration rates increase

FOOTAGE DRILLED per rig increased sharply in 1959 to the second highest average in U. S. industry history, despite a surge of shallow drilling in some areas. But the general trend toward deeper drilling helped to cause a slight decline in wells drilled per rig.

With an average of 4,178 rigs in operation in 1959, activity resulted in an average of 48,475 feet of hole and 11.6 wells drilled for each rig used. The footage drilled was an increase of 1,056 feet over the 47,419 feet per rig in 1958, and almost equaled the 48,583 feet achieved in the record year 1956. The 11.6 wells drilled per rig in 1959 compared with 11.8 wells in 1958.



Average Wells and Footage Drilled Annually Per Rig in U.S.

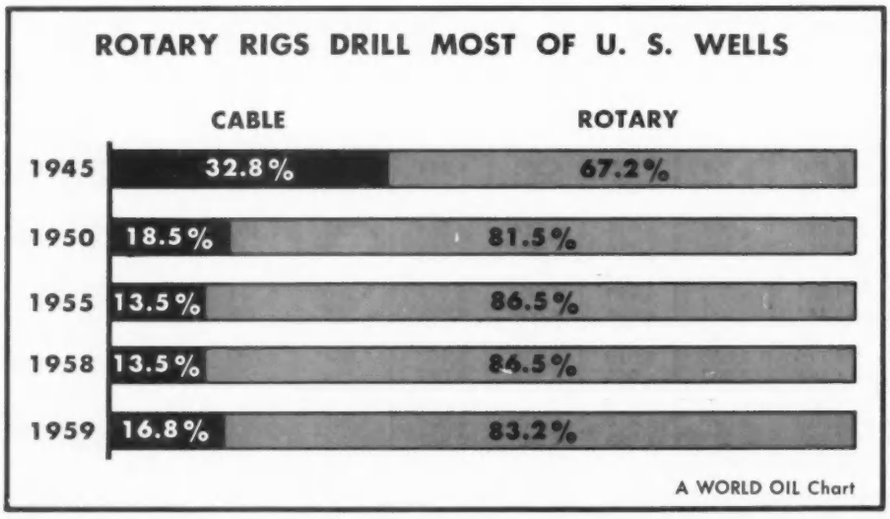
YEAR	Average Rigs Operating	Wells Drilled Per Rig	Footage Drilled Per Rig
1938	3,799	7.7	23,844
1939	3,683	7.6	23,221
1940	4,193	7.4	22,933
1941	4,446	7.3	22,345
1942	3,041	7.2	22,329
1943	3,041	6.7	20,385
1944	4,190	6.2	20,138
1945	4,387	6.1	21,195
1946	4,353	6.9	23,231
1947	4,741	7.0	23,796
1948	4,950	8.0	27,618
1949	4,290	9.1	32,312
1950	4,517	9.6	35,369
1951	4,844	9.5	36,490
1952	4,857	9.6	38,785
1953	4,784	10.3	41,478
1954	4,635	11.2	45,587
1955	4,867	11.5	46,955
1956	4,845	12.1	48,583
1957	4,791	11.2	46,100
1958	4,114	11.8	47,419
1959	4,178	11.6	48,475

Rotary method yielding ground to cable tools

FOLLOWING A TREND, continuous since the end of 1955, cable tool completions increased in the United States last year at the expense of rotary holes. Based on estimates and total completion tabulations, cable tool completions in 1959 totaled 8,141, up 1,616 from the 6,525 estimated for 1958. Perhaps significantly, this increase approximates the number of cable tool completions in Greensburg oil field in Kentucky last year.

Rotary completions were estimated at 40,187 last year, down from the 41,806 estimated for 1958.

With drilling becoming ever more competitive, companies are taking a new look at the economics of cable tools, particularly in shallow areas. However, air and gas rotaries are invading the previous domains of cable tool rigs, particularly the Appalachians. Both drilling methods are used occasionally in combination there, and also in Michigan.



Estimated Number of Wells Drilled in U. S. by Rotary and Cable Tool Methods

YEAR	ROTARY		CABLE	
	Wells	Percent	Wells	Percent
1945	17,908	67.2	8,741	32.8
1946	20,859	69.0	9,371	31.0
1947	23,269	70.2	9,878	29.8
1948	29,410	74.5	10,067	25.5
1949	30,975	79.5	7,987	20.5
1950	35,295	81.5	8,012	18.5
1951	37,717	82.0	8,279	18.0
1952	38,368	82.5	8,139	17.5
1953	41,316	83.5	8,164	16.5
1954	44,368	85.0	7,829	15.0
1955	48,335	86.5	7,544	13.5
1956	51,116	87.5	7,302	12.5
1957	46,791	87.0	6,992	13.0
1958	41,806	86.5	6,525	13.5
1959	40,187	83.2	8,141	16.8

Independents drill 78.8% of all U.S. wells

During 1959, smaller operators drilled more than 50 percent of wells in 34 out of 38 oil producing areas

U.S. INDEPENDENT operators and smaller companies drilled 78.8 percent of all U.S. wells, and from 90 to 100 percent of the wells in many areas during 1959.

Independents drilled about 38,065 new wells out of 48,328 completed in the United States. This is indicated by the accompanying table, based on the drilling reports of 23 major companies. The larger companies drilled 10,263 wells, or 21.2 percent of the U.S. total.

During 1959, from 95 to 100 percent of the drilling was accounted for by independent operators and smaller companies in Alabama, Arkansas, Kentucky, Ohio, Tennessee and West Virginia. In most of these states wells are predominately shallow, production is small, and drilling costs are moderate.

Independents drilled 90 to 95 percent of the wells in Indiana, Kansas, North Louisiana, Michigan and North Central and North Texas. They drilled 80 to 90 percent of the wells in Colorado, Illinois, Nebraska and the Middle Gulf, Lower Gulf (S.W.), East Central and Northeast regions of Texas.

Independents drilled between 73 and 78 percent of the wells, or slightly less than their national average, in Mississippi, Oklahoma, Pennsylvania, the Texas Panhandle and Wyoming. About 77.6 percent of the 17,597 wells drilled in Texas were accounted for by independents. They drilled between 60 and 73 percent of the wells in Florida, Montana, North Dakota, West Central Texas and West Texas.

Smaller operators drilled 57.1 percent of the 14 wells drilled in Alaska, and 56.5 percent of the total in South Central Texas.

Big company areas. There are only four areas where the independent operators and smaller companies drill fewer wells than the major companies. They are South Louisiana, California, South Dakota and Utah.

During 1959, independents drilled only 41.2 percent of the 2,288 wells drilled in South Louisiana. They are handicapped in this area by the large amount of capital required. South Louisiana has the deepest drilling in the United States. It also has much offshore drilling, where even the majors drill jointly to hold down costs.

Independents drilled only 46.1 percent of the wells in California, 21.7 percent in South Dakota, and 29.2 percent in Utah. In these areas they are deterred by such factors as scarcity of promising acreage, deep and relatively expensive drilling, or limited market outlets for crude oil.

In contrast, major companies often have choice leases, can finance costly development, and can wait longer for markets for crude.

There has been little change in the ratio of independent to major company drilling effort in recent years.

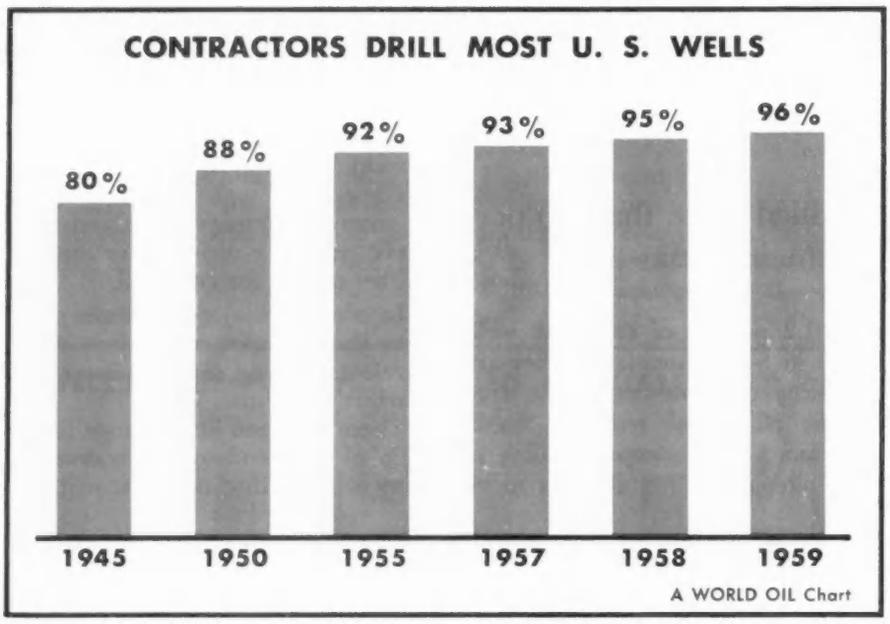
Independent Operators Drilled Large Proportions of Wells in Majority of States in 1959

(Table is based on combined data for 24 larger companies)

STATE or DISTRICT	Total Wells Drilled	24 Larger Companies*		Rest of Industry	
		Wells	% of Total	Wells	% of Total
Alabama	108	2	1.9	106	98.1
Alaska	14	6	42.9	8	57.1
Arkansas	814	18	2.2	796	97.8
California	1,487	801	53.9	686	46.1
Colorado	726	143	19.7	583	80.3
Florida	10	3	30.0	7	70.0
Illinois	2,032	367	18.1	1,665	81.9
Indiana	847	57	6.7	790	93.3
Kansas	3,831	378	9.9	3,453	90.1
Kentucky	2,930	12	0.4	2,918	99.6
Louisiana	3,831	1,465	38.2	2,366	61.8
North Louisiana	1,543	120	7.8	1,423	92.2
South Louisiana	2,288	1,345	58.8	943	41.2
Michigan	596	51	8.6	545	91.4
Mississippi	669	162	24.2	507	75.8
Montana	342	101	29.5	241	70.5
Nebraska	825	137	16.6	688	83.4
New Mexico	1,819	610	33.5	1,209	66.5
New York	278	67	24.1	211	75.9
North Dakota	433	170	39.3	263	60.7
Ohio	1,085	5	0.5	1,080	99.5
Oklahoma	5,192	1,143	22.0	4,049	78.0
Pennsylvania	695	155	22.3	540	77.7
South Dakota	23	18	78.3	5	21.7
Tennessee	107	....	....	107	100.0
Texas	17,597	3,939	22.4	13,658	77.6
R.R. Comm. District:					
1: South Central	979	426	43.5	553	56.5
2: Middle Gulf	786	114	14.5	672	85.5
3: Upper Gulf	1,190	353	29.7	837	70.3
4: Lower Gulf-S.W.	1,308	227	17.4	1,081	82.6
5-6: East Central and North East	1,002	172	17.2	830	82.8
7B-9: North Central and North	5,889	411	7.0	5,478	93.0
7C-8: West Central and West	5,194	1,935	37.3	3,259	62.7
10: Panhandle	1,249	301	24.1	948	75.9
Utah	291	206	70.8	85	29.2
West Virginia	783	1	0.1	782	99.9
Wyoming	902	237	26.3	665	73.7
†Other States	61	9	14.8	52	85.2
Total United States	48,328	10,263	21.2	38,065	78.8

*Amerada, Atlantic, Carter, Cities Service, Continental, Gulf, Humble, Mobil, Ohio, Pan American, Phillips, Pure, Richfield, Shell, Sinclair, South Penn, Standard of California (California Co. and Standard of Texas), Sun, Sunrny Mid-Continent, Tennessee Gas, Texaco, Tidewater, Union Oil of Califoraia, and Union Producing.

†Arizona, Georgia, Idaho, Maryland, Nevada, Oregon, Virginia.



Contractors drill 96% of all U.S. wells

CONTRACTORS CONTINUED to increase their share of the U.S. drilling effort last year, with the following results:

• Wells drilled by contractors totaled 46,395, for 96 percent of all U.S. wells—up slightly from the previous highs of 95 percent reported in 1957 and 1958.

• Footage drilled by contractors increased to 194,427,149 feet, up 9.1 million feet over 1958.

Although contractors accounted for a larger percentage of total drilling in 1959, their efforts still were far below the peak year of 1956, when they drilled 54,329 wells with a resultant footage figure of almost 219 million feet.

Wells and Footage Drilled in U.S. by Contractors, by Years

YEAR	Indicated Work by Contractors		
	% of U.S.	Wells	Footage
1941	72	23,407	71,503,354
1942	70	15,393	47,532,137
1943	75	15,262	46,492,893
1944	78	20,113	65,815,196
1945	80	21,319	74,385,690
1946	81	24,486	81,911,096
1947	81	26,849	91,381,060
1948	82	32,371	112,101,505
1949	85	33,118	117,824,400
1950	88	38,118	140,590,324
1951	90	41,396	159,081,496
1952	91	42,321	171,226,143
1953	91	45,027	180,572,756
1954	92	48,021	194,392,465
1955	92	51,409	210,247,313
1956	93	54,329	218,909,390
1957	93	50,018	205,745,514
1958	95	46,236	185,329,506
1959	96	46,395	194,427,149

Data on percent of work by contractors from American Association of Oilwell Drilling Contractors.

Drilling equipment prices level off

DRILLING EQUIPMENT prices remained fairly stable during 1959, with only four of 16 major pieces of equipment showing increases. This is in sharp contrast with 1958, when all but three of 18 pieces of equipment went up in price.

However, several factors point to a new round of drilling equipment price increases in 1960, i.e., an expected $4-$5 per ton increase in steel prices to offset the $1 billion boost in labor costs that will result from the industry's new union contract.

There were only two major price increases last year, and one decrease. Combination hooks jumped 7.5 percent, for the largest percentage increase recorded during 1959—following a 4.2 percent boost in 1958. Portable cable tool rigs increased 5.8 percent in price last year, after a 2.8 percent increase in 1958.

Wholesale Price Indexes of Major Drilling Equipment
1947-1949 = 100

	Dec. 1954	Dec. 1958	Nov. 1959*	Percent Change	
				1954-1959	1958-1959
Portable Drill Rig, Cable Tool	125.9	168.9	178.7	+ 41.9	+ 5.8
Portable Drill Rig, Rotary	126.5	142.1	142.1	+ 12.3	.....
Traveling Block	123.5	143.2	143.2	+ 16.0	.....
Drawworks	122.8	153.2	153.2	+ 24.8	.....
Rotary Table	137.2	167.3	167.3	+ 21.9	.....
Combination Hook	121.0	150.9	162.2	+ 34.0	+ 7.5
Rotary Slip	116.0	151.8	151.8	+ 30.9	.....
Swivel	139.5	185.0	186.4	+ 33.6	+ 0.8
Blowout Preventer	136.3	164.1	164.1	+ 20.4	.....
Rock Bit	127.1	133.8	133.8	+ 5.3	.....
Coring Equipment	124.7	148.6	151.3	+ 21.3	+ 1.8
Tool Joint	127.6	157.9	157.9	+ 23.7	.....
Drill Collar	103.8	105.2	102.2	— 1.5	— 2.9
Kelly-Drill Stem	115.1	147.2	147.2	+ 27.9	.....
Rotary Fishing Tools	112.6	144.3	144.8	+ 28.6	+ 0.3
Slush Pumps	143.2	186.2	186.2	+ 30.0	.....

* Preliminary.
SOURCE: Bureau of Labor Statistics.

Drilling-crude production ratio drops again

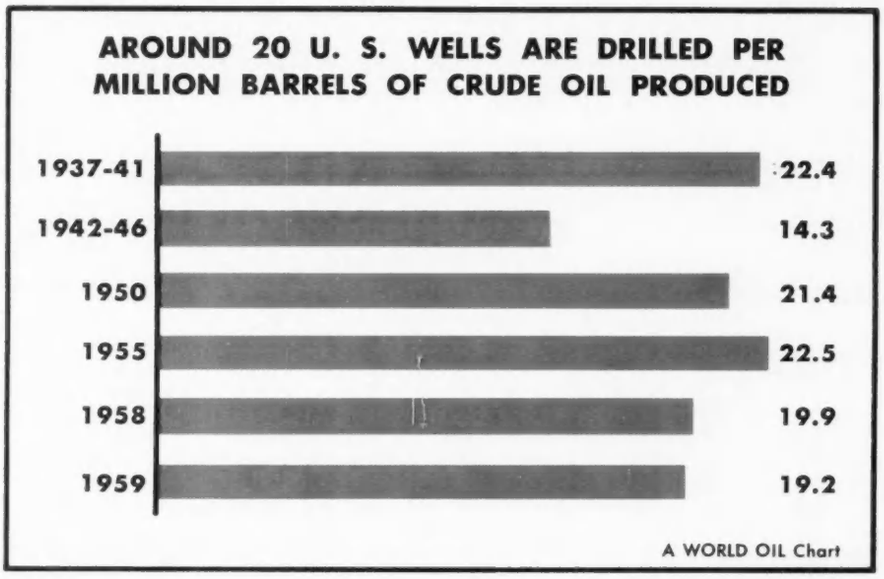
THE NUMBER of wells drilled in relation to number of barrels of crude oil produced in the United States declined in 1959 for the fourth consecutive year. Last year 19.2 wells were completed for each million barrels of crude produced, compared with 19.7 in 1958.

Fewer well completions per million barrels of production probably have resulted from several factors. Incentive to drill new wells has been reduced by large excess producing capacity, low production allowables per well, weak markets for crude and products, less urgent need for discovering new fields and efforts toward wider well spacing.

The 1959 drilling-production ratio was the lowest since 1948, when 18.5 wells were completed per million barrels produced. The ratio increased from 19.8 in 1951 to 22.5 in 1955, but has declined since then.

Wells Drilled Per Million Barrels Produced

1937-1941	22.4	1952	19.8
1942-1946	14.3	1953	20.5
		1954	22.2
1947	17.1	1955	22.5
1948	18.5		
1949	20.5	1956	22.3
1950	21.4	1957	20.6
		1958	19.9
1951	19.8	1959	19.2



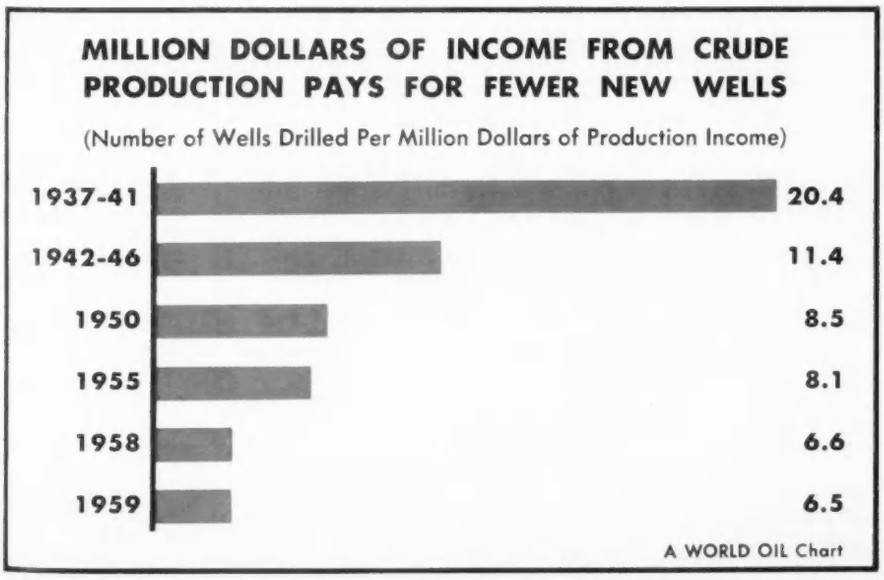
Drilling-producing income ratio declines

FOLLOWING a long-term trend, the number of wells drilled compared with income received from U.S. crude oil production fell to a new low in 1959. Only 6.5 wells were drilled for each million dollars of crude production income, compared with 6.6 in 1958.

The number of wells drilled per million dollars of income has decreased rather steadily from 8.7 in early postwar 1947, 11.4 during the war, and 20.4 in pre-war 1937-1941.

A major cause of the decline in wells drilled per million dollars received by the producer has been the drop of the purchasing power of the dollar from 100 cents pre-war to less than 50 cents now. A million dollars now buys fewer automobiles, houses, or wells. But it buys a particularly reduced number of wells, because of deeper drilling, offshore development, relatively more wildcats and other factors.

The producer is helped to drill enough wells to support his production in that he receives more dollars per barrel produced, although operators say that crude price raises have not fully compensated for increases in their costs.



Wells Drilled Per Million Dollars of Production Income

1937-1941	20.4	1952	7.8
1942-1946	11.4	1953	7.6
		1954	8.0
1947	8.7	1955	8.1
1948	7.1		
1949	8.1	1956	8.0
1950	8.5	1957	6.7
		1958	6.6
1951	7.8	1959	6.5

Wildcat drilling to rise slightly during 1960

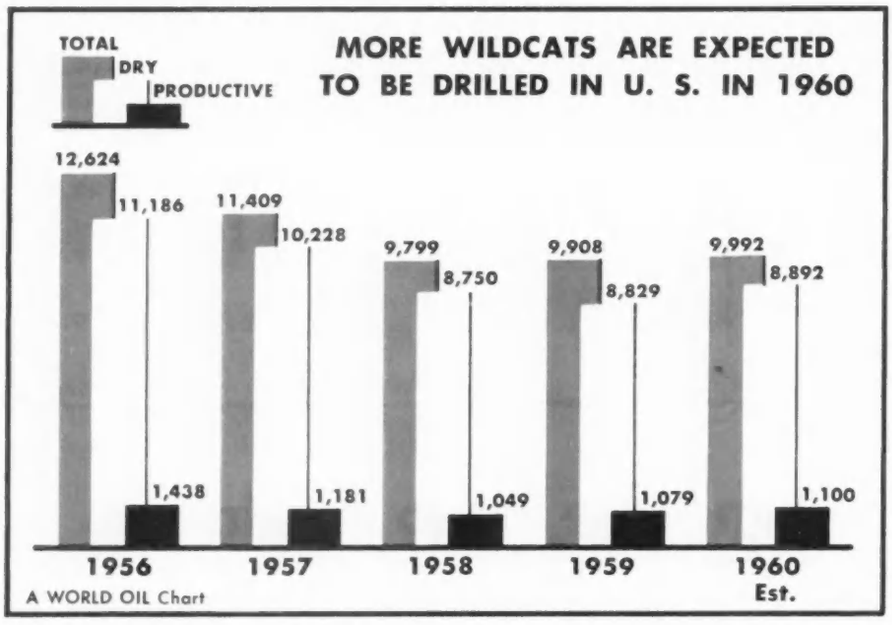
WILDCATTING ACTIVITY in the United States, for the second consecutive year, will record a slight increase. According to WORLD OIL estimates, 9,992 wildcats will be drilled in 1960, up 84 wells or 0.8 percent over the 9,908 exploratory tests drilled last year. The 1959 total was an increase of 109 from the 9,799 drilled during 1958.

However, in 1958 the drilling of 9,799 exploratory tests reflected a sizable decrease of 1,610 wells from 1957. And 1957, in turn, recorded a drop of 1,215 wells from the previous record year, when 12,624 wildcats were drilled.

The decline which occurred in 1957 followed a period in which U.S. wildcat activity had increased rapidly over a 10-year term, reaching its peak in 1956, when total wildcats more than doubled the 4,983 wells drilled in 1947.

The anticipated increase in wildcat drilling this year is predicated on the brighter prospects for increased production resulting from an improvement in demand and better stock conditions. However, unless the market situation improves, crude prices versus increased drilling costs will hold the wildcatting increase to a slim level during the next 12 months.

The number of wildcats drilled during 1959 was 109 wells above the 1958 total; the number of productive wildcats increased 30 wells, and the dry hole total increased by 79 wells. The relationship between total dry holes to total wildcats drilled and productive wells illustrates the increasing difficulty in locating new crude production.



Texas No. 1. As the nation's leading state in wildcat activity, Texas will account for 38.5 percent of U.S. wildcat drilling during 1960. A total of 3,850 wells is forecast for Texas, up

Forecast of U.S. Wildcat Tests to Be Drilled in 1960

STATE or DISTRICT	Forecast For 1960	Drilled In 1959	% Diff. '59-'60
Alabama	25	30	— 16.7
Alaska	10	9	+ 11.1
Arizona	35	35	.....
Arkansas	145	129	+ 12.4
California	300	327	— 8.3
Colorado	435	390	+ 11.5
Illinois	465	499	— 6.8
Indiana	330	252	+ 30.9
Kansas	1,140	1,188	— 4.0
Kentucky	75	89	— 15.7
Louisiana	565	537	+ 5.2
North Louisiana	220	212	+ 3.8
South Louisiana	345	325	+ 6.2
[1]Gulf of Mexico	45	36	+ 25.0
Michigan	210	167	+ 25.7
Mississippi	240	252	— 4.8
Missouri	12	11	+ 9.1
Montana	140	110	+ 27.3
Nebraska	355	377	— 5.8
New Mexico	215	279	— 22.9
Southeast	170	189	— 10.1
Northwest	85	90	— 5.6
North Dakota	75	83	— 9.6
Ohio	35	41	— 14.6
Oklahoma	740	729	+ 1.5
Pennsylvania	25	24	+ 4.2
South Dakota	30	14	+114.3
Tennessee	75	57	+ 31.6
Texas	3,850	3,825	+ 0.6
Dist. 1: South Central	360	308	+ 16.9
Dist. 2: Middle Gulf	295	283	+ 4.2
Dist. 3: Upper Gulf	315	287	+ 9.7
Dist. 4: Lower Gulf-S.W.	425	410	+ 3.6
Dist. 5 & 6: East	305	259	+ 17.8
Dist. 7-B & 9: North	1,275	1,333	— 4.4
Dist. 7-C & 8: West	715	789	— 9.4
Dist. 10: Panhandle	160	156	+ 2.6
Utah	75	84	— 10.7
West Virginia	....	1	.....
Wyoming	370	350	+ 5.7
Other States*	20	19	+ 5.3
Total United States	9,992	9,908	+ 0.8

* Other States include Florida, Georgia, Maryland, Nevada, Oregon, Virginia and Washington. [1] Gulf of Mexico wells are included in South Louisiana figures.

25 wells over 1959. In comparison, Texas wildcat activity declined 144 wells in 1959, from the 3,969 wildcats drilled in 1958—and the 1958 total dropped 1,056 wells or 20 percent in 1958 from the 5,025 wildcats drilled in the year 1957.

Second in wildcatting activity, Kansas will decrease its total 48 wells or 4 percent to 1,140 wildcats this year, following a 196-well increase to 1,188 wildcats in 1959.

Oklahoma, third ranking wildcatting state in the nation, will record an increase in wildcatting to the extent of 21 wells, or 1.5 percent, for a total of 740 wildcats in 1960. The 729 wildcats drilled in Oklahoma during the past year represented a 41-well decrease from 1958.

Results of Wildcat Drilling in United States, by Years

	PRODUCTIVE WILDCATS												DRY WILDCATS			TOTAL WILDCATS		
	OIL			DISTILLATE			GAS			TOTAL PRODUCTIVE								
YEAR	No.	Footage	Avge. Depth	No.	Footage	Avge. Depth	No.	Footage	Avge. Depth	No.	Footage	Avge. Depth	No.	Footage	Avge. Depth	No.	Footage	Avge. Depth
1937	203	831,123	4094	3	19,377	6459	33	77,389	2345	239	927,889	3882	1,943	7,173,550	3692	2,182	8,101,439	3713
1938	229	944,455	4124	4	23,657	5914	31	102,440	3305	264	1,070,552	4055	2,179	7,012,901	3218	2,443	8,083,453	3309
1939	224	782,289	3492	1	7,999	7999	33	103,450	3135	258	893,738	3464	2,488	7,764,816	3121	2,746	8,658,554	3153
1940	262	957,167	3653	2	12,792	6396	46	122,439	2662	310	1,092,398	3524	2,672	8,649,828	3237	2,982	9,742,226	3267
1941	301	1,165,966	3874	3	23,505	7835	58	177,974	3069	362	1,367,445	3777	3,047	9,651,013	3167	3,409	11,018,458	3232
1942	288	1,199,382	4165	13	121,620	9355	48	167,428	3488	349	1,488,430	4265	2,652	9,320,691	3515	3,001	10,809,121	3602
1943	276	1,232,396	4465	15	140,564	9371	56	212,814	3800	347	1,585,774	4570	2,951	10,702,429	3627	3,298	12,288,203	3726
1944	326	1,422,250	4363	32	250,228	7820	102	417,944	4097	460	2,090,422	4544	3,425	13,470,846	3933	3,885	15,561,268	4005
1945	317	1,503,763	4744	30	269,915	8997	113	486,529	4306	460	2,260,207	4913	3,486	14,504,642	4161	3,946	16,764,849	4249
1946	308	1,359,787	4415	29	264,441	9119	75	272,564	3634	412	1,896,792	4604	3,830	14,399,824	3760	4,242	16,296,616	3842
1947	436	1,999,100	4585	44	352,691	8016	96	403,038	4198	576	2,754,829	4783	4,407	17,068,382	3873	4,983	19,823,211	3978
1948	610	2,760,127	4525	70	626,026	8943	112	514,990	4598	792	3,901,143	4926	5,618	22,227,790	3957	6,410	26,128,933	4076
1949	668	3,027,759	4533	69	644,454	9340	130	626,058	4816	867	4,298,271	4958	5,914	22,044,695	3728	6,781	26,342,966	3885
1950	811	3,607,484	4448	67	572,807	8549	137	679,851	4962	1,015	4,860,142	4788	6,876	25,882,014	3764	7,891	30,742,156	3896
1951	992	4,767,425	4806	62	564,243	9101	172	937,257	5449	1,226	6,268,925	5113	8,552	34,526,359	4037	9,778	40,795,284	4172
1952	982	4,751,818	4839	111	1,038,256	9354	174	924,735	5315	1,267	6,714,809	5300	8,972	39,430,757	4395	10,239	46,145,566	4507
1953	1,062	5,322,266	5012	97	833,326	8591	259	1,326,976	5123	1,418	7,482,568	5277	9,325	41,551,971	4456	10,743	49,034,539	4564
1954	1,056	5,525,392	5232	118	997,846	8456	260	1,384,545	5325	1,434	7,907,783	5514	9,387	42,227,607	4499	10,821	50,135,390	4633
1955	1,085	5,625,626	5185	123	1,087,452	8841	236	1,163,846	4932	1,444	7,876,924	5455	10,157	47,707,546	4697	11,601	55,584,470	4791
1956	1,070	5,754,326	11296	110	1,042,679	17480	258	1,512,509	5862	1,438	8,309,514	5779	11,186	50,233,797	4491	12,624	58,543,311	4637
1957	848	4,724,116	5571	120	1,190,984	9925	213	1,235,630	5801	1,181	7,150,730	6055	10,228	46,549,595	4551	11,409	53,700,325	4707
1958	743	4,073,165	5,482	80	755,645	9446	226	1,296,860	5738	1,049	6,125,670	5840	8,750	40,296,787	4605	9,799	46,422,457	4737
1959	713	4,003,012	5614	85	822,634	9678	281	1,769,844	6298	1,079	6,595,490	6113	8,829	42,558,060	4820	9,908	49,153,550	4961

Results of Wildcat Drilling in the United States in 1959, by States

	PRODUCTIVE WILDCATS												DRY WILDCATS			TOTAL WILDCATS		
	OIL			DISTILLATE			GAS			TOTAL PRODUCTIVE								
STATE or DISTRICT	No.	Footage	Avge.	No.	Footage	Avge.	No.	Footage	Avge.	No.	Footage	Avge.	No.	Footage	Avge.	No.	Footage	Avge.
Alabama													30	124,705	4157	30	124,705	4157
Alaska	1	12,046	12046				1	15,047	15047	2	27,093	13547	7	67,693	9670	9	94,786	16531
Arkansas	7	31,151	4450				10	50,892	5089	17	82,043	4826	112	448,323	4003	129	530,366	4111
California	7	44,557	6365				7	38,143	5449	14	82,700	5907	313	1,650,745	5274	327	1,733,445	5301
Colorado	25	133,975	5359				16	100,399	6275	41	234,374	5716	349	1,838,441	5268	390	2,072,815	5315
Illinois	11	24,641	2240				2	3,412	1706	13	28,053	2158	486	902,927	1858	499	930,980	1866
Indiana	3	3,630	1210				1	1,382	1382	4	5,012	1253	248	364,516	1470	252	369,528	1466
Kansas	148	578,909	3912				30	156,629	5221	178	735,538	4132	1,010	3,844,218	3806	1,188	4,579,756	3855
Kentucky	10	17,715	1772							10	17,715	1772	79	98,362	1245	89	116,077	1304
Louisiana	29	241,047	8312	16	208,249	13016	13	143,196	11015	58	592,492	10215	479	4,451,419	9293	537	5,043,911	9393
North Louisiana	17	97,442	5732	1	11,952	11952	5	36,620	7324	23	146,014	6348	189	997,531	5278	212	1,143,545	5394
South Louisiana	12	143,605	11967	15	196,297	13086	8	106,576	13322	35	446,478	12756	290	3,453,888	11910	325	3,900,366	12001
*Gulf of Mexico	2	20,464	10232	4	55,220	13805	4	57,902	14476	10	133,586	13359	26	317,709	12220	36	451,295	12536
Michigan	4	16,334	4084				5	19,096	3819	9	35,430	3937	158	532,391	3370	167	567,821	3400
Mississippi	9	93,981	10442	1	12,398	12398	2	16,883	8442	12	123,262	10272	240	2,166,775	9028	252	2,290,037	9087
Missouri	1	380	380							1	380	380	10	9,794	979	11	10,174	925
Montana	3	22,187	7396				1	2,817	2817	4	25,004	6251	106	540,160	5096	110	565,164	5138
Nebraska	39	232,653	5965							39	232,653	5965	338	1,943,854	5751	377	2,176,507	5773
New Mexico	34	236,489	6956	1	6,257	6257	31	180,494	5822	66	423,240	6413	213	1,002,269	4705	279	1,425,509	5109
Southeast New Mexico	25	182,463	7299				5	35,641	7128	30	218,104	7270	159	827,692	5206	189	1,045,796	5533
Northwest New Mexico	9	54,026	6003	1	6,257	6257	26	144,853	5571	36	205,136	5698	54	174,577	3233	90	379,713	4219
North Dakota	16	112,346	7022							16	112,346	7022	67	396,818	5923	83	509,164	6135
Ohio	8	28,031	3504				8	32,979	4122	16	61,010	3813	25	88,574	3543	41	149,584	3648
Oklahoma	77	484,106	6287	12	94,426	7869	39	271,746	6968	128	850,278	6643	601	2,544,797	4234	729	3,395,075	4657
Pennsylvania	1	7,048	7048				4	21,922	5481	5	28,970	5794	19	94,216	4959	24	123,186	5133
South Dakota	3	25,432	8477							3	25,432	8477	11	65,577	5960	14	91,009	6501
Tennessee													57	54,932	964	57	54,932	964
Texas	249	1,487,117	5972	54	497,700	9217	96	620,164	6460	399	2,604,981	6529	3,426	16,849,608	4918	3,825	19,454,589	5086
Dist. 1: South Central	8	44,448	5556	1	6,755	6755	1	3,300	3300	10	54,503	5450	298	953,129	3198	308	1,007,632	3272
Dist. 2: Middle Gulf	11	77,301	7027	14	123,973	8855	15	93,037	6203	40	294,311	7358	243	1,569,614	6459	283	1,863,925	6586
Dist. 3: Upper Gulf	11	103,181	9380	24	244,869	10203	9	75,322	8369	44	423,372	9622	243	2,056,067	8461	287	2,479,439	8639
*Gulf of Mexico							1	11,005	11005	1	11,005	11005	3	28,179	9393	4	39,184	9796
Dist. 4: L. Gulf-S.W.	16	98,072	6130	12	103,732	8644	11	75,335	6849	39	277,139	7106	371	2,010,528	5419	410	2,287,667	5580
*Gulf of Mexico													1	500	500	1	500	500
Dist. 5 & 6: East	13	84,517	6501	1	5,998	5998	9	68,570	7619	23	159,085	6917	236	1,383,307	5861	259	1,542,392	5955
Dist. 7-B & 9: North	88	353,451	4016	1	2,433	2433	20	80,561	4028	109	436,445	4004	1,224	4,256,040	3477	1,333	4,692,485	3520
Dist. 7-C & 8: West	88	609,989	6932				17	94,465	5557	105	704,454	6709	684	3,830,886	5601	789	4,535,340	5748
Dist. 10: Panhandle	14	116,158	8297	1	9,940	9940	14	129,574	9255	29	255,672	8816	127	790,037	6221	156	1,045,709	6703
Utah	5	32,859	6572				4	17,338	4335	9	50,197	5577	75	437,007	5827	84	487,204	5800
Washington													4	31,928	7982	4	31,928	7982
West Virginia													1	276	276	1	276	276
Wyoming	22	130,298	5923	1	3,604	3604	10	70,518	7052	33	204,420	6195	317	1,837,643	5797	350	2,042,063	5834
Other States	1	6,080	6080				1	6,787	6787	2	12,867	6434	48	170,092	3545	50	182,959	3659
Total, U.S., 1959	713	4,003,012	5614	85	822,634	9678	281	1,769,844	6298	1,079	6,595,490	6113	8,829	42,558,060	4820	9,908	49,153,550	4961

* Gulf of Mexico wells included in their respective district totals.

Ratio of U.S. Wildcatting to All Drilling and Proportion of Wildcats Discovering New Fields, by Years, 1937-1959

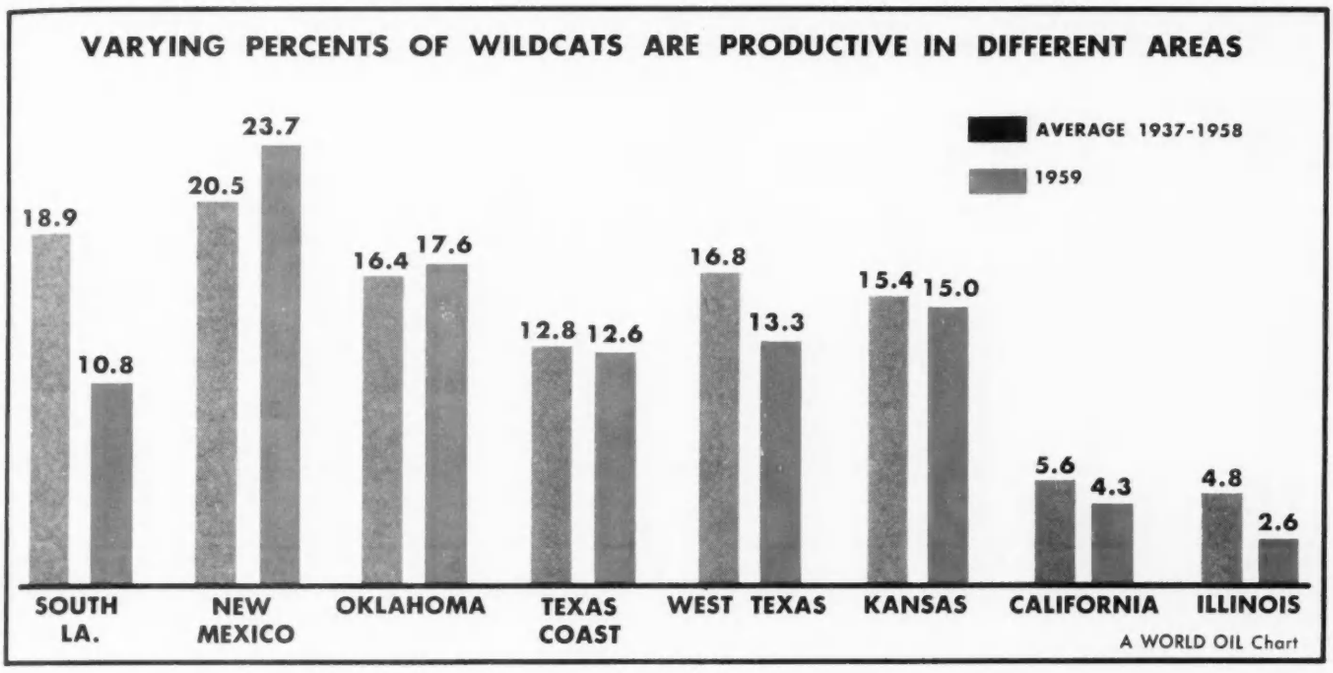
YEAR	Total New Wells Drilled for Oil or Gas*	TOTAL WILDCATS		Dry Wildcats	PRODUCTIVE WILDCATS					
					TOTAL		OIL		GAS & DISTILLATE	
		Number	Percent of All Wells		Number	Percent of All Wildcats	Number	Percent of All Wildcats	Number	Percent of All Wildcats
1937	32,474	2,182	6.7	1,943	239	11.0	203	9.3	36	1.6
1938	27,764	2,443	8.8	2,179	264	10.8	229	9.4	35	1.4
1939	26,654	2,746	10.3	2,488	258	9.4	224	8.2	34	1.2
1940	29,161	2,982	10.2	2,672	310	10.4	262	8.8	48	1.6
1941	30,149	3,409	11.3	3,047	362	10.6	301	8.8	61	1.8
1942	19,729	3,001	15.2	2,652	349	11.6	288	9.6	61	2.0
1943	18,641	3,298	17.7	2,951	347	10.5	276	8.4	71	2.1
1944	23,733	3,885	16.4	3,425	460	11.8	326	8.4	134	3.4
1945	24,482	3,946	16.1	3,486	460	11.7	317	8.1	143	3.6
1946	28,145	4,242	15.1	3,830	412	9.7	308	7.3	104	2.5
1947	31,084	4,983	16.0	4,407	576	11.6	436	8.8	140	2.8
1948	37,448	6,410	17.1	5,618	792	12.4	610	9.5	182	2.9
1949	37,812	6,781	17.9	5,914	867	12.8	668	9.9	199	2.9
1950	42,173	7,891	18.7	6,876	1,015	12.9	811	10.3	204	2.6
1951	44,571	9,778	21.9	8,552	1,226	12.5	992	10.1	234	2.5
1952	45,275	10,239	22.6	8,972	1,267	12.4	982	9.6	285	2.8
1953	48,242	10,743	22.3	9,325	1,418	13.2	1,062	9.9	356	3.3
1954	51,419	10,821	21.0	9,387	1,434	13.3	1,056	9.8	378	3.5
1955	55,207	11,601	21.0	10,157	1,444	12.4	1,085	9.3	359	3.1
1956	57,390	12,624	22.0	11,186	1,438	11.4	1,070	8.5	368	2.9
1957	52,391	11,409	21.8	10,228	1,181	10.4	848	7.4	333	2.9
1958	47,402	9,799	20.7	8,750	1,049	10.7	743	7.6	306	3.1
1959	47,563	9,908	20.8	8,829	1,079	10.9	713	7.2	366	3.7

* Not including service wells.

Ratio of U.S. Wildcatting to All Drilling and Proportion of Wildcats Discovering New Fields, by States, 1937-1959

STATE or DISTRICT	TWENTY-TWO YEARS, 1937-1958						YEAR, 1959					
	WILDCATS						WILDCATS					
	*Total New Wells Drilled for Oil or Gas	TOTAL		Dry	PRODUCTIVE		*Total New Wells Drilled for Oil or Gas	TOTAL		Dry	PRODUCTIVE	
		Number	Percent of All Wells		Number	Percent of All Wildcats		Number	Percent of All Wells		Number	Percent of All Wildcats
Alabama	880	532	60.5	521	11	2.1	108	30	27.8	30	.....	.....
Alaska	.....	.....	.....	.....	.....	.....	14	9	64.3	7	2	22.2
Arkansas	9,299	1,997	21.5	1,828	169	8.5	812	129	15.9	112	17	13.2
California	41,114	5,982	14.5	5,649	333	5.6	1,444	327	22.6	313	14	4.3
Colorado	8,277	4,122	49.8	3,754	368	8.9	726	390	53.7	349	41	10.5
Florida	289	270	93.4	268	2	0.7	10	10	100.0	10	.....	.....
Georgia	78	78	100.0	78	.....	.....	.....	.....	.....	.....	.....	.....
Illinois	56,824	12,350	21.7	11,760	590	4.8	2,032	499	24.6	486	13	2.6
Indiana	15,850	4,582	28.9	4,234	348	7.6	838	252	30.1	248	4	1.6
Kansas	65,179	13,538	20.8	11,459	2,079	15.4	3,785	1,188	31.4	1,010	178	15.0
Kentucky	26,775	2,436	9.1	2,142	294	12.1	2,903	89	3.1	79	10	11.2
Louisiana	46,890	6,963	14.8	6,002	961	13.8	3,828	537	14.0	479	58	10.8
North Louisiana	23,109	3,223	13.9	2,970	253	7.8	1,543	212	13.7	189	23	10.8
South Louisiana	23,781	3,740	15.7	3,032	708	18.9	2,285	325	14.2	290	35	10.8
Michigan	16,434	5,336	32.5	4,961	375	7.0	596	167	28.0	158	9	5.4
Mississippi	6,486	2,582	39.8	2,430	152	5.9	669	252	37.7	240	12	4.8
Missouri	1,030	312	30.3	307	5	1.6	14	11	78.6	10	1	9.1
Montana	6,373	1,353	21.2	1,225	128	9.5	340	110	32.4	106	4	3.6
Nebraska	5,013	2,471	49.3	2,222	249	10.1	824	377	45.8	338	39	10.3
New Mexico	19,463	2,588	13.3	2,057	531	20.5	1,812	279	15.4	213	66	23.7
New York	14,817	156	1.1	142	14	9.0	203	.....	.....	.....	.....	.....
North Dakota	1,948	671	34.4	595	76	11.3	425	83	19.5	67	16	19.3
Ohio	24,130	510	2.1	457	53	10.4	1,083	41	3.8	25	16	39.0
Oklahoma	90,701	11,314	12.5	9,467	1,847	16.3	5,075	729	14.4	601	128	17.6
Pennsylvania	35,595	239	0.7	182	57	23.8	590	24	4.1	19	5	20.8
South Dakota	172	164	95.3	162	2	1.2	23	14	60.9	11	3	21.4
Tennessee	742	421	56.7	400	21	5.0	107	57	53.3	57	.....	.....
Texas	290,109	60,629	20.9	52,620	8,009	13.2	17,293	3,825	22.1	3,426	399	10.4
Dist. 1: South Central	13,924	4,838	34.7	4,530	308	6.4	978	308	31.5	298	10	3.2
Dist. 2: Middle Gulf	[1]	[1]	.....	[1]	[1]	.....	786	283	36.0	243	40	14.1
Dist. 3: Upper Gulf	27,262	5,670	20.8	4,986	684	12.1	1,190	287	24.1	243	44	15.3
Dist. 4: L. Gulf-S.W.	45,033	11,655	25.9	10,116	1,539	13.2	1,302	410	31.5	371	39	9.5
Dist. 5: East Central	[2]	[2]	.....	[2]	[2]	.....	162	77	47.5	73	4	5.2
Dist. 6: Northeast	22,328	4,350	19.5	4,064	286	6.6	839	182	21.7	163	19	10.4
Dist. 7-B: N. Central	[3]	[3]	.....	[4]	[3]	.....	2,371	794	33.5	711	83	10.5
Dist. 7-C: W. Central	[4]	[4]	.....	[4]	[4]	.....	740	251	33.9	218	33	13.1
Dist. 8: West	72,837	9,696	13.3	8,066	1,630	16.8	4,344	538	12.4	466	72	13.4
Dist. 9: North	92,296	23,625	25.6	20,239	3,386	14.3	3,336	539	16.2	513	26	4.8
Dist. 10: Panhandle	16,429	795	4.8	619	176	22.1	1,245	156	12.5	127	29	18.6
Utah	1,332	649	48.7	583	66	10.2	290	84	29.0	75	9	10.7
Virginia	239	36	15.1	27	9	25.0	.....	.....	.....	.....	.....	.....
Washington	65	63	96.9	63	.....	.....	4	4	100.0	4	.....	.....
West Virginia	16,257	223	1.4	142	81	36.3	780	1	0.1	1	.....	.....
Wyoming	10,015	2,347	23.4	2,022	325	13.8	888	350	39.4	317	33	9.4
Other States	394	262	66.5	251	11	4.2	47	40	85.1	38	2	5.0
Total, U.S.	812,770	145,176	17.9	128,010	17,166	11.8	47,563	9,908	20.8	8,829	1,079	10.9

* Not including service wells. [1] Dist. 2 included with Dist. 4. [2] Dist. 5 included with Dist. 6. [3] Dist. 7-B included with Dist. 9. [4] Dist. 7-C included with Dist. 8.



10.9 percent of U.S. wildcats produce in 1959

A TOTAL OF 1,079 or 10.9 percent of the 9,908 wildcats finished in the United States last year found oil, gas or condensate production. This percentage constitutes a slight improvement over 1958, when 1,049 or 10.7 percent of 9,799 wildcats were completed as producers, and over 1957, when 1,181 or 10.4 percent of 11,409 yielded production.

The 10.9 percent success ratio of 1959 compares unfavorably with the 11.8 percent national average over the 1937-1958 period, and with the 11.4 percent ratio of 1956. However, it is well above the 9.7 percent ratio of 1946. It is hoped that the improvement of 1959 and 1958 may indicate a trend toward use of more effective exploration methods, to offset the handicap of steadily less favorable and more picked-over prospects.

Among major oil producing areas, New Mexico's 23.7 percent (66 of 279) success ratio in 1959 was outstanding. This represents an improvement over both the 1958 ratio of 20.0 percent and the 1937-58 average of 20.5 percent. North Dakota, with 16 strikes in 83 wildcats finished last year, enjoyed a 19.3 percent success ratio. Oklahoma hit on 128 of 729 wildcats in 1959, for a success ratio of 17.6 percent, a considerable jump from the 15.4 percent of 1958.

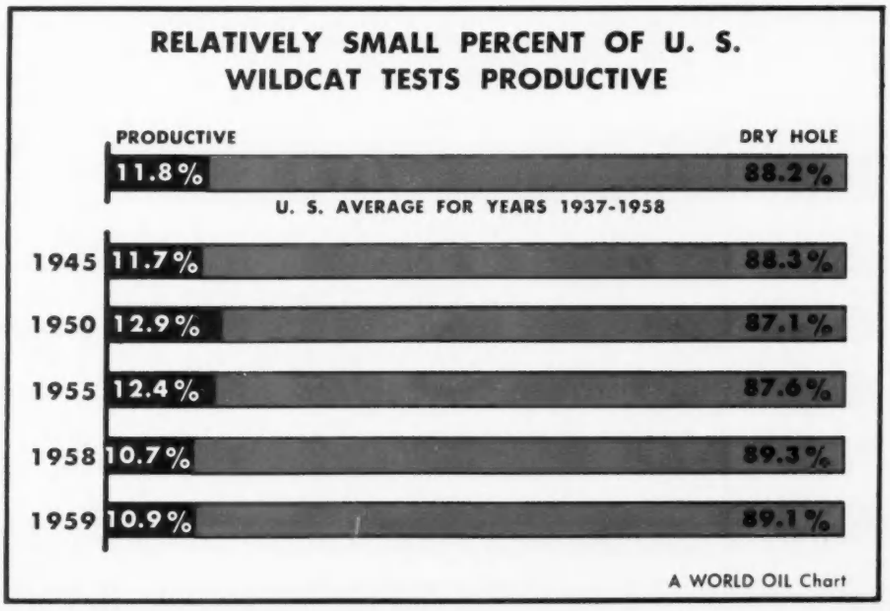
The Panhandle was the most successful percentage-wise last year of Texas regions; 29 of 156 wildcats were successful for a ratio of 18.6. This was a drop, however, from 1958 when 33 or 25.2 percent of the 131 wildcats drilled were successful. Of 325 south Louisiana wildcats completed, 35, or an average of 10.8 percent were successful last year, down from the 11.8 ratio of 1958.

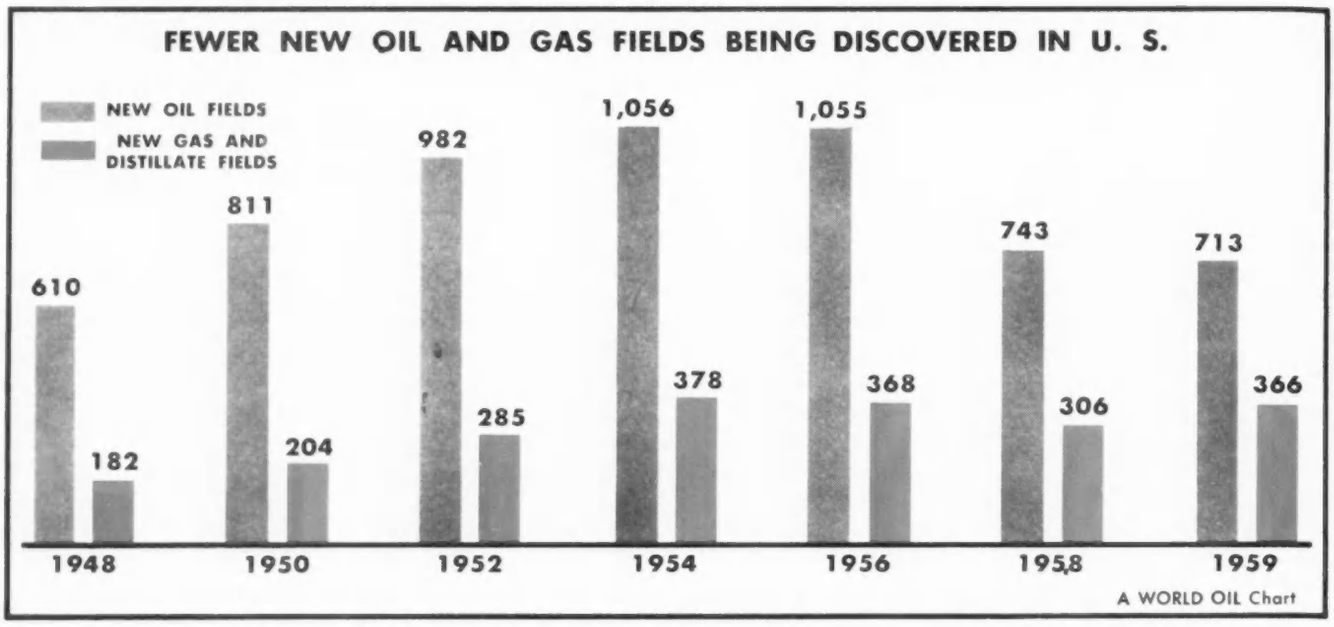
Kansas enjoyed an outstanding year in 1959, with 178 of 1,188 wildcats (15 percent) finding production.

In Arkansas, 17 wildcats out of 129 completed in 1959 found production, for a 13.2 percent ratio.

In the Rocky Mountain states, the 1959 success ratio appears generally to be slightly better than the national average. But the new reserves indicated, particularly in the Paradox Basin, are much more significant than success ratios indicate.

In the Appalachians, success ratios are generally high. In 1959 they ranged from 39 percent in Ohio to 11.2 percent in Kentucky.





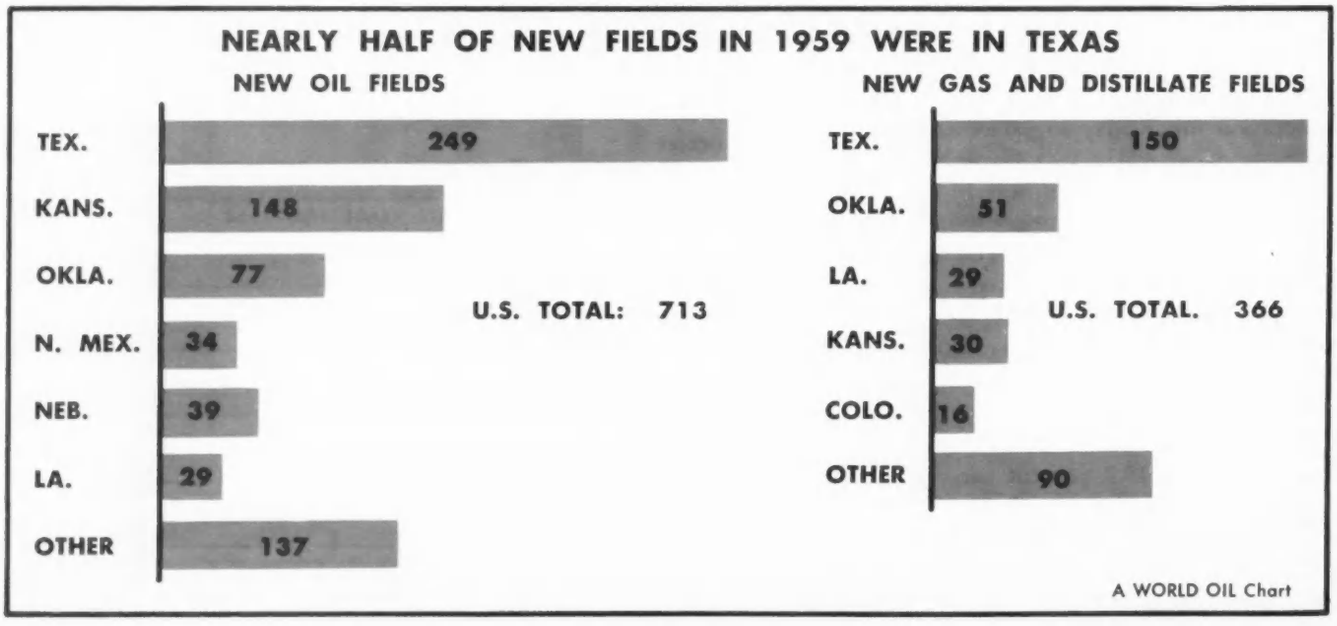
New gas fields up, oil down from 1958

REVERSING a three-year downward trend since the peak year of 1955, the total of new gas and distillate fields found in the United States in 1959 increased to a total of 366, 60 more than the 306 recorded in 1958. However, the total of new oil field discoveries dropped to 713, 30 less than the 743 found in 1958. The total of new fields found in 1959 was 1,079, an increase of 30 over the 1,049 recorded in 1958.

The increased demand for gas in interstate markets, and improved intrastate markets, coupled with poor market demand for crude oil in many U.S. producing areas, probably serve to explain the new exploratory trends.

The same reasoning is heavily reflected in certain area studies. In Texas, new oil field discoveries dropped from 306 in 1958, to 249 in 1959, while new gas and distillate finds increased from 127 to 150. Market conditions for Texas crude are generally unsatisfactory from the producers' viewpoint, whereas gas markets are better in some areas. Fewer new oil fields were also found in New Mexico and Louisiana in 1959 than in 1958. New gas finds increased in 1959 in Oklahoma, Louisiana and Kansas, as well as in Texas.

While Texas, Louisiana and New Mexico had decreases in oil field discoveries in 1959, there were increases in Kansas, Oklahoma, Nebraska and in all other states combined. Kansas was outstanding, with 148 new discoveries, up 21 from the 127 new oil fields recorded in 1958.

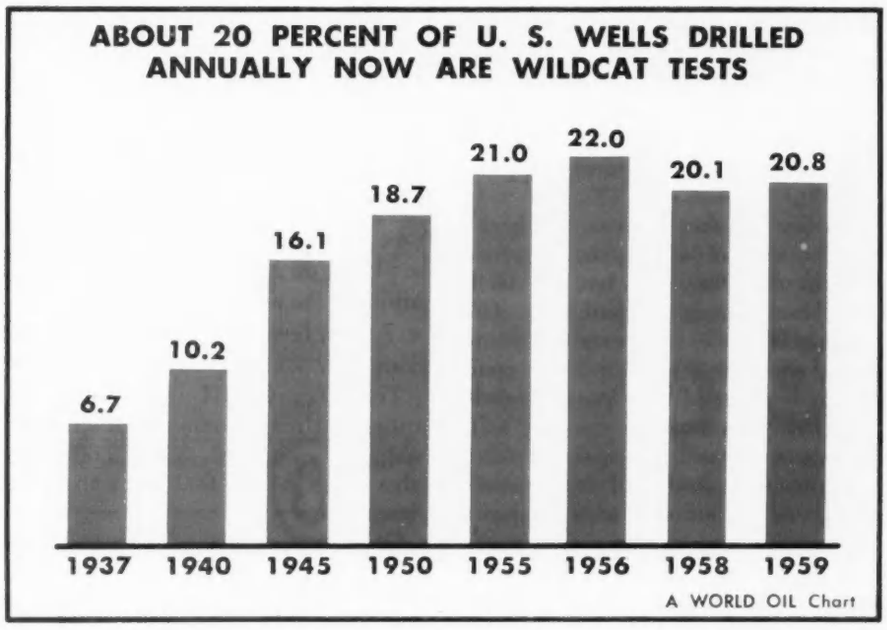


Exploratory drilling takes upturn

THE RATIO of wildcats to all wells drilled in the United States last year increased slightly over 1958. The 9,908 wildcats finished in 1959 amounted to 20.8 percent of total completions, compared with the 20.1 percent ratio of 1958.

This increase in exploratory drilling reverses a two-year downward trend. In 1956, wildcats reached a high of 22 percent of all completions. This ratio dropped to 21.8 percent in 1957 and to 20.1 percent in 1958. It is hoped that the upsurge in wildcatting indicated by the 1959 record reflects renewed confidence in the investment climate for the U. S. oil industry in the quest for new reserves.

Indirectly, the trend toward ever-increased well spacing for development wells may be tending to increase the ratio of wildcats. Available data indicate that less than 10 percent of U. S. completions were wildcats prior to 1939. The tendency toward close well spacing in earlier days tended to offset a similar tendency toward random wildcatting insofar as the statistics are concerned.



Wildcats made up a large proportion of total completions in 1959 in several major producing states, including Colorado, 53.7 percent; Nebraska, 45.8; Wyoming, 39.4; and Mississippi, 37.7 percent. Six Texas areas had high wildcat ratios also, varying from 31.5 to 47.5 percent.

Kansas wildcat ratio increases

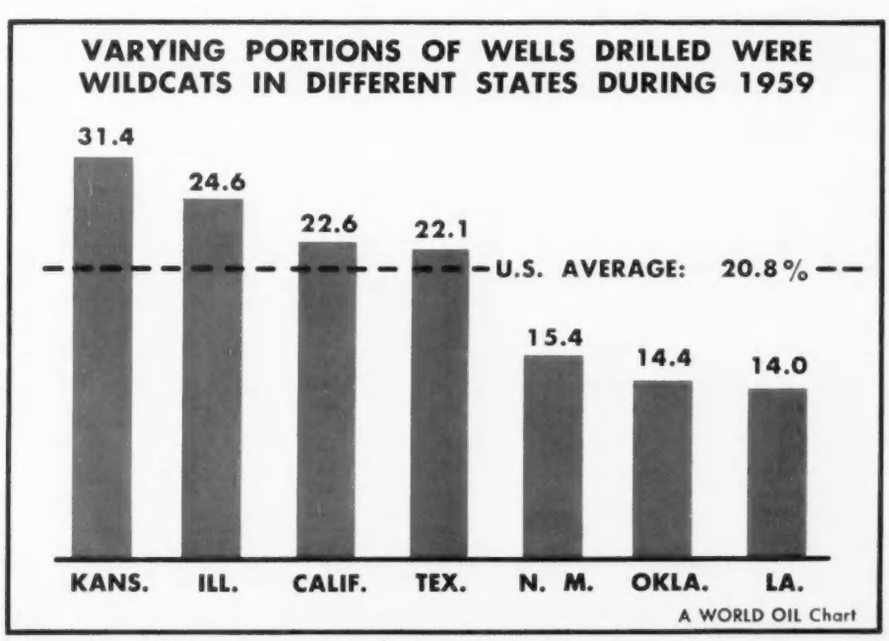
KANSAS CONTINUES to be outstanding among U. S. oil states in the ratio of wildcats to all completions. The ratio in 1959 was 31.4 percent, a hefty increase from the 26.4 percent recorded in 1958.

In Illinois, another haven of wildcatters, the wildcat ratio dropped slightly from 25.6 percent in 1958 to 24.6 percent in 1959. However, following the Siloam discovery in Brown County, completed late in 1959, it is very likely that wildcat completions will increase in 1960, with an entire new area opened to shallow exploration.

The exploratory drilling ratio in California increased from 20.6 percent in 1958 to 22.6 percent in 1959. The over-all Texas figures dropped from 23 percent to 22.1 percent. Hence, California's position has been enhanced, spurred by increased exploration for gas in the Sacramento Valley. Some Texas areas are well above the over-all Texas ratio also.

The ratio in Oklahoma increased strongly in 1959, from 10.9 percent in 1958 to 14.4 percent last year. An increase was also recorded in New Mexico, from 14 percent in 1958 to 15.4 percent in 1959. On the other hand, in Louisiana the ratio dropped from 17.3 percent in 1958 to 14 percent last year.

In many less productive states, of course, wildcat ratios were higher, since such a relatively few development wells were being drilled.



Artificial lift increase is predicted

WORLD OIL estimates that 24,291 U.S. wells will be placed on artificial lift during 1960. In addition, expenditures for equipment required to maintain existing artificially lifted wells are expected to reach a total of $88,511,000.

Continuing the postwar trend, the total number of wells going on artificial lift in 1960 will be 379 wells more than during the past year. The increase is due to prospects that more new producing wells will be completed, because of anticipated slightly higher drilling activity.

Some wells will be equipped with equipment transferred from abandoned wells, but the wide majority will require new equipment.

At the close of 1959, there were 520,919 U.S. wells on artificial lift, 14,522 more than a year ago.

Forecast by states. As the United States' leading drilling and oil producing state, Texas again is expected to have the greatest number of wells to be placed on artificial lift. WORLD OIL estimates the total will be 10,390 wells, or 7 wells fewer than during the previous year.

Too, Texas will lead in lifting equipment maintenance expenditures, with an estimated $30,372,000, an advance of $1,820,000 from the previous year.

Oklahoma again will record this year the second largest number of wells to go on artificial lift in the United States, with 2,430. The state's equipment expenditures for existing artificial lift wells is estimated at $11,029,000—the third largest in the nation.

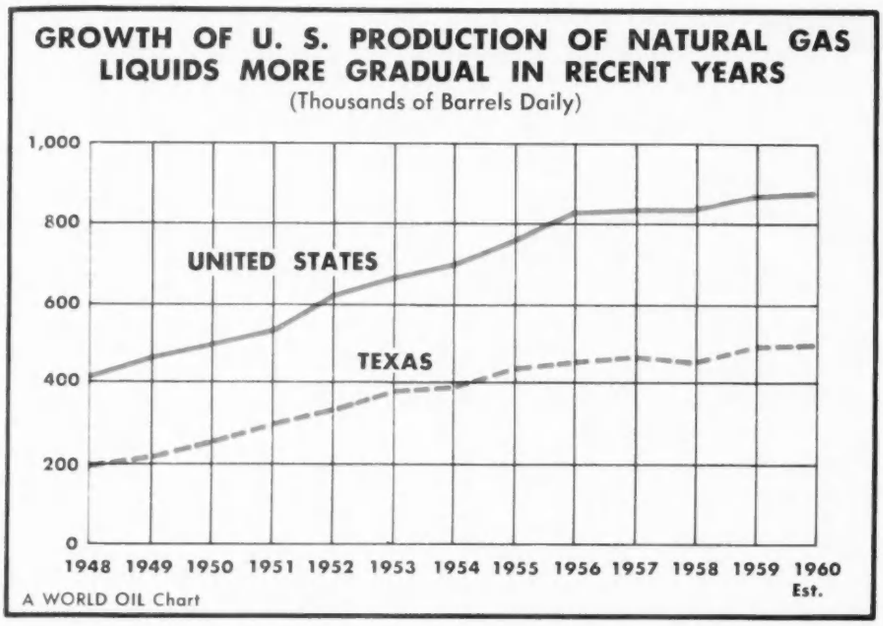
Oklahoma's total number of wells expected to go on artificial lift indicates an increase of 27 wells from last year's figure of 2,403 wells.

Kansas barely outpaced Kentucky to retain its No. 3 position, with an expected 1,650 wells to go on artificial lift. Maintenance expenditures in the state are expected to increase this year to $5,664,000, up $189,000 from 1959's $5,475,000.

Forecast of U.S. Wells To Go on Artificial Lift in 1960

STATE or DISTRICT	Est. Wells to go on Artificial Lift in 1960	Wells Put on Pump or Lift in 1959	New Oil Wells Completed in 1959	No. Oil Wells Flowing End of 1959	Oil Wells on Artificial Lift End of 1959	New Wells Shut in or Abandoned in 1959	Est. Maintenance Cost For All Art. Lift Wells in 1960 (Equipment only)
Alabama	**53**	**73**	**75**	**29**	**244**	**56**	**$ 30,000**
Arkansas	**570**	**502**	**448**	**178**	**5,881**	**38**	**857,000**
California	**1,025**	**1,034**	**859**	**1,115**	**36,101**	**103**	**16,806,000**
Colorado	**355**	**329**	**138**	**382**	**1,701**	**253**	**329,000**
Illinois	**1,010**	**1,066**	**963**	**128**	**38,736**	**696**	**4,787,000**
Indiana	**300**	**284**	**280**	**169**	**5,303**	**75**	**611,000**
Kansas	**1,650**	**1,552**	**1,664**	**243**	**39,921**	**764**	**5,664,000**
Kentucky	**1,530**	**1,554**	**1,565**	**19**	**21,137**	**—601†**	**2,672,000**
Louisiana	**1,175**	**1,062**	**1,805**	**9,280**	**13,805**	**433**	**2,303,000**
North Louisiana	780	695	772	1,683	10,801	219	1,634,000
South Louisiana	395	367	1,033	7,597	3,004	214	669,000
Michigan	**310**	**221**	**239**	**59**	**4,332**	**87**	**687,000**
Mississippi	**240**	**226**	**257**	**383**	**2,236**	**77**	**521,000**
Montana	**295**	**227**	**151**	**331**	**3,375**	**62**	**617,000**
Nebraska	**265**	**273**	**268**	**21**	**1,473**	**120**	**315,000**
New Mexico	**776**	**838**	**1,096**	**4,530**	**7,657**	**—280†**	**2,454,000**
New York	**140**	**145**	**145**	.....	**19,275**	**400**	**1,219,000**
North Dakota	**345**	**370**	**259**	**392**	**988**	**22**	**146,000**
Ohio	**500**	**513**	**498**	**160**	**14,768**	**595**	**1,036,000**
Oklahoma	**2,430**	**2,403**	**2,619**	**2,987**	**78,128**	**1,256**	**11,029,000**
Pennsylvania	**205**	**195**	**195**	.....	**67,580**	**1,100**	**3,926,000**
Texas	**10,390**	**10,397**	**9,816**	**47,366**	**138,298**	**3,830**	**30,372,000**
Dist. 1: South Central	670	598	528	352	7,569	239	1,383,000
Dist. 2: Middle Gulf	250	229	207	3,254	2,362	179	502,000
Dist. 3: Upper Gulf	600	539	497	4,567	8,187	474	1,485,000
Dist. 4: Lower Gulf-S.W.	570	559	413	4,781	7,011	473	1,423,000
Dist. 5 & 6: E. Cent. & N. E.	825	689	497	11,842	15,363	283	3,991,000
Dist. 7-B & 9: N. Cent. & N.	3,035	3,163	3,026	3,991	44,265	1,902	10,118,000
Dist. 7-C & 8: W. Cent. & W.	3,700	3,963	3,906	18,236	41,564	284	9,300,000
Dist. 10: Panhandle	740	657	742	343	11,977	—4†	2,170,000
Utah	**127**	**133**	**162**	**346**	**317**	**57**	**53,000**
West Virginia	**155**	**147**	**147**	.....	**12,885**	**77**	**856,000**
Wyoming	**350**	**347**	**369**	**489**	**6,629**	**52**	**1,191,000**
Other States*	**95**	**21**	**25**	**7**	**149**	**21**	**30,000**
Total United States	**24,291**	**23,912**	**24,043**	**68,614**	**520,919**	**9,293**	**$88,511,000**

* Alaska, Arizona, Florida, Missouri, Nevada, South Dakota, Tennessee, Virginia and Washington.
† Net wells put back on production.



Natural gas liquids output to set new record in 1960

NATURAL GAS liquids production continues to set annual records. After reaching a new high in 1959, the U.S. Bureau of Mines forecasts production will set another record this year, increasing to a yearly total of 320,982,000 barrels, or 877,000 barrels per day.

This forecast represents a modest increase of 4,000 barrels per day or 0.5 percent over 1959. Last year, natural gas liquids production averaged 873,000 barrels per day—up 65,000 barrels daily or 8 percent over 1958. Total annual production for 1958 amounted to 318,645,000 barrels.

Much of last year's increase resulted from a significant jump in demand for liquefied petroleum gas (butane and propane). Natural gasoline production averaged 261,900 barrels per day during the latter months of 1959, up 4,900 barrels daily or 1.9 percent over the same 1958 period.

Big gains for LPG. Demand for LPG increased 16.5 percent over 1958 to 567,058 barrels per day. This compares with a 7.5 percent increase in 1958 over 1957. Annual demand in 1959 totaled 206,976,190 barrels.

LPG demand for domestic and commercial uses are estimated at 235,095 barrels per day, up 9.4 percent over 1958. This continues to be the biggest market, although the percentage has dropped from 51.2 percent of total sales in 1954 to 41.5 percent in 1959. The most important factor in domestic growth continues to be house heating, as home owners continue to convert to LPG from other fuels.

Growth in other uses of LPG is as follows:

Motor fuel. Demand for LPG as motor fuel increased 10 percent last year to an annual total of 22,309,524 barrels, or 61,122 barrels per day.

The largest volume was for use in farm tractors. However, the use of LPG in industrial lift and tow trucks, continues to increase at a faster rate than any of the other LPG motor fuel uses.

Chemicals. Reflecting increasing markets for petrochemicals, demand for LPG as a raw material for manufacture of chemicals was up 26.2 percent over 1958. They continued to take a larger share of the market, totaling an estimated 156,295 barrels per day.

The above figure does not include LPG used in the manufacture of synthetic rubber, which increased 32 percent over 1958 to 11,690,476 barrels annually, or 32,029 barrels per day. The volumes consumed for synthetic rubber components and for manufacture of other chemicals accounted for more than one-third of the total LPG market.

Industrial and other uses. Demand for industrial and miscellaneous uses increased 26.5 percent to a total of 24,285,714 barrels per year, or 66,536 barrels per day—a large factor being greater refinery fuel use.

Sales to gas utilities rose 2.6 percent to 15,982 barrels daily. Although the extension of natural gas pipe lines caused displacement of LPG in some areas, the over-all effect has been to stimulate interest in LPG as well as natural gas, and to create the need for additional standby units.

Production of LPG, including the mixed streams going to petrochemical use and refinery fuel, was nearly 18 percent over 1958. This increase was partly due to more complete coverage of many mixed streams.

U.S. Production of Natural Gas Liquids

(Source: Bureau of Mines except Nov.-Dec., 1959, estimated. New series beginning 1941 includes cycle condensate.)

(THOUSANDS OF BARRELS)

Year	Total	Daily	Year	Total	Daily	Year	Total	Daily
Natural Gasoline			1932....	36,281	99	1946....	115,739	317
1918.....	6,727	18	1933....	33,810	93	1947....	132,173	362
1919.....	8,370	23	1934....	36,556	100	1948....	146,721	401
1920.....	9,161	25	1935....	39,333	108	1949....	157,086	430
1921.....	10,713	29				1950....	181,961	499
			1936....	42,770	117			
1922.....	12,044	33	1937....	49,177	135	1951....	204,754	561
1923.....	19,434	53	1938....	51,347	141	1952....	223,515	611
1924.....	22,235	61	1939....	51,650	142	1953....	238,579	654
1925.....	26,845	74	1940....	55,700	152	1954....	252,133	691
1926.....	32,455	89	**Natural Gas Liquids**			1955....	281,371	771
1927.....	39,075	107	1941....	80,855	222	1956....	292,727	800
1928.....	43,191	118	1942....	83,222	228	1957....	294,990	808
1929.....	53,183	146	1943....	87,716	240	1958....	294,749	808
1930.....	52,631	144	1944....	100,046	273	1959....	318,645	873
1931.....	43,617	119	1945....	112,004	307	1960 Est....	320,982	877

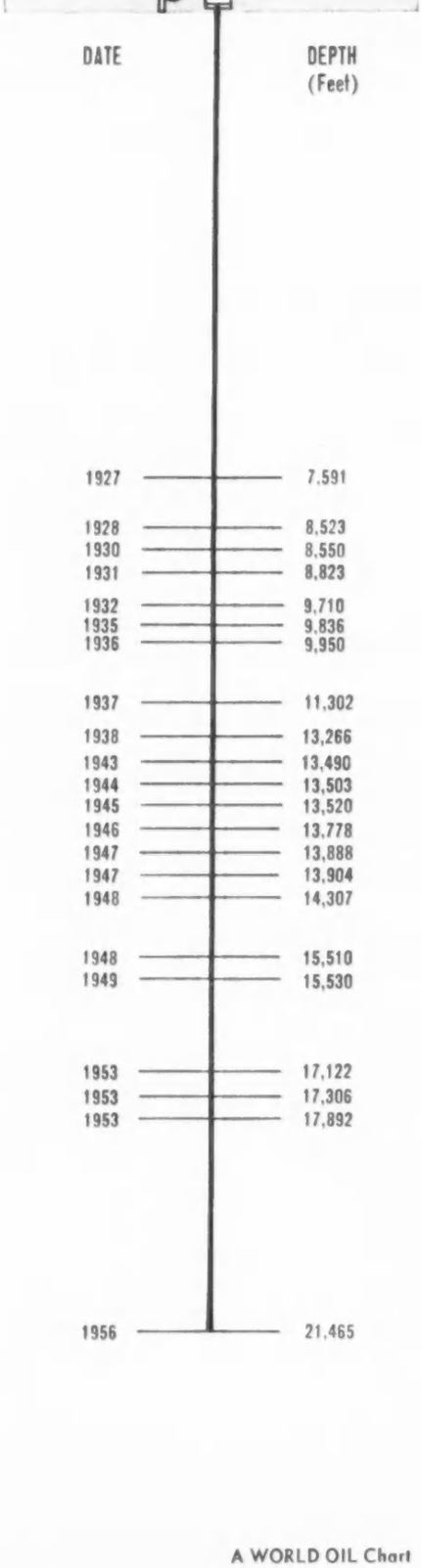
Ten U.S. areas set new producing depth records

TEN OF THE 40 U.S. oil and gas areas reported new depth records for producing wells during 1959. Five of the new record holders are oil wells, three are gas-condensate, and two are gas wells.

The Texas Gulf Coast entered the 16,000-foot category for the first time with the completion of Pure Oil Company's Houston Farms Development Company 1 gas-condensate well, at Green's Lake, Galveston County, from basil Frio formation at 16,264 feet. Thus, the Texas Gulf Coast has moved from the nation's tenth deepest producing area (with a 14,156-foot well completed in 1958) to fifth place.

The North Texas-Panhandle area moved from eighteenth place to eleventh with the completion of Standard of Texas' McAdams 2 gas-condensate well, Grayson County, from Ordovician (Simpson) Oil Creek sand at 12,884 feet. Other wells producing from record depths are listed below.

- East Texas. Humble Oil & Refining Company's Floyd D. Elledge 1 in New Hope field, Franklin County, yielding condensate from 12,506 feet.
- Utah. Standard Oil Company of California's Uintah-Ouray 3, wildcat in Duchesne County, producing oil from 11,895 feet. The well was drilled to 13,354 feet total depth.
- Alaska. Standard of California-Richfield et al's Swanson River Unit, No. 34-10, producing oil from the Hemlock Zone (Eocene) at 11,543 feet.



A WORLD OIL Chart

Holders of Record as Deepest Producing Well in U. S., Since 1927

Year Drilled	WELL AND LOCATION	Production	Bottom of Pay (Feet)
1927	E. J. Miley's Athens 6, Rosecrans field, California	....	7,591
1928	Texon Oil & Land Co.'s University 1-B, Big Lake field, West Texas	Oil	8,523
1930	Star Petroleum Co.'s Colby 2, Long Beach, California	....	8,550
1931	Tide Water Associated Oil Co.'s Lloyd 57, Ventura Avenue field, California	Oil	8,823
1932	Tide Water Associated Oil Co.'s Lloyd 83, Ventura Avenue field, California	Oil	9,710
1935	Tide Water Associated Oil Co.'s Lloyd 131, Ventura Avenue field, California	Oil	9,836
1936	The Texas Co.'s Lafitte 5, Lafitte field, South Louisiana	Oil	9,950
1937	Union Oil Co.'s Kernco 85-34, Rio Bravo field, Kern County, California	Oil	11,302
1938	Fohs Oil Co.'s Buckley-Bourg 1, DeLarge field, South Louisiana	*Cond.	13,266
1943	Union Producing Co.-Fohs Oil Co.'s Fitzpatrick-Vizard 1, DeLarge field, South Louisiana	*Cond.	13,490
1944	Union Producing Co.-Fohs Oil Co.'s Buckley-Bourg 2, DeLarge field, South Louisiana	Oil	13,503
1945	Shell Oil Co.'s Smith-State Unit 1-1, Weeks Island field, South Louisiana	Oil	13,520
1946	Shell Oil Co.'s Smith-State Unit 1-2, Weeks Island field, South Louisiana	Oil	13,778
1947	Shell Oil Co.'s Smith-State Unit 1-3, Weeks Island field, South Louisiana	Oil	13,888
1947	The Texas Co.'s LaFourche Basin Levee Dist. 1, Queen Bess Island field, South Louisiana	*Cond.	13,904
1948	Pure Oil Co.'s Unit 1, West Poison Spider field, Wyoming	Oil	14,307
1948	Denver Producing & Refg. Co.'s School Land 1-A, Cogar field, Caddo County, Okla.	Gas	15,510
1949	Standard Oil Co. of California's Mushrush 5, Wasco field, Kern County, California	Oil	15,530
1953	Shell Oil Co.'s Weeks-Gall Unit 1-1, Weeks Island field, South Louisiana	Oil	17,122
1953	Shell Oil Co.'s Gonsoulin Minvielle-State 2, Weeks Island field, South Louisiana	Oil	17,306
1953	Richfield Oil Corp.'s Cole Levee "A" 67-29, Coles Levee, North field, California	Oil	17,892
1956	Richardson & Bass et al's Humble-LL&E 1-L, Lake Washington field, South Louisiana	Oil	21,465

• Colorado. California Company's Bald Creek 1 wildcat gas producer in Garfield County, from 10,256 feet.

• Kansas. Westhoma Oil Company's Long 1, in Seward County's Wide Awake field, oil from 6,512 feet.

• Ohio. Ohio Fuel Gas Company—East Ohio Gas Company-Wiser Oil Company's F. Smith 1-A in Medina County, gas from 6,790 feet.

• Arizona. Texas Pecific Coal and Oil Company's No. 1 Navajo Tract 138, Apache County, wildcat oil producer from 5,589 feet.

• Illinois. Texaco's H. Silverman 16, oil producer in Wayne County's Aden Consolidate pool, from Dutch Creek (Devonian) pay at 5,338 feet.

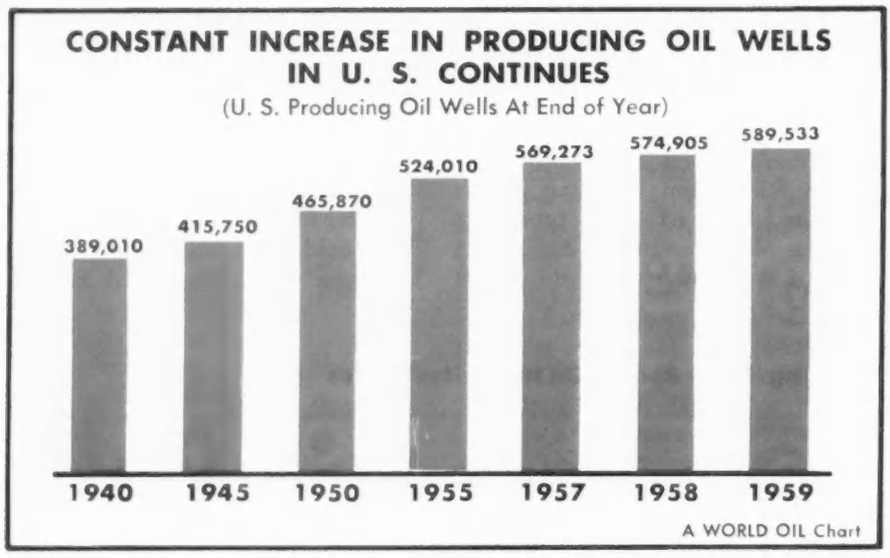
Deepest wells. For the fourth year, the nation's deepest inshore producing well is Richardson and Bass et al's Humble LL&E 1-L, now producing oil from Miocene sand at 20,502 feet in the Lake Washington field, South Louisiana. The well was originally completed May 5, 1956, through perforations at the 21,419-21,435 and 21,443-21,465 foot intervals; later was plugged back to 20,745 feet in 1957; and in 1959 was re-completed at 12,502 feet.

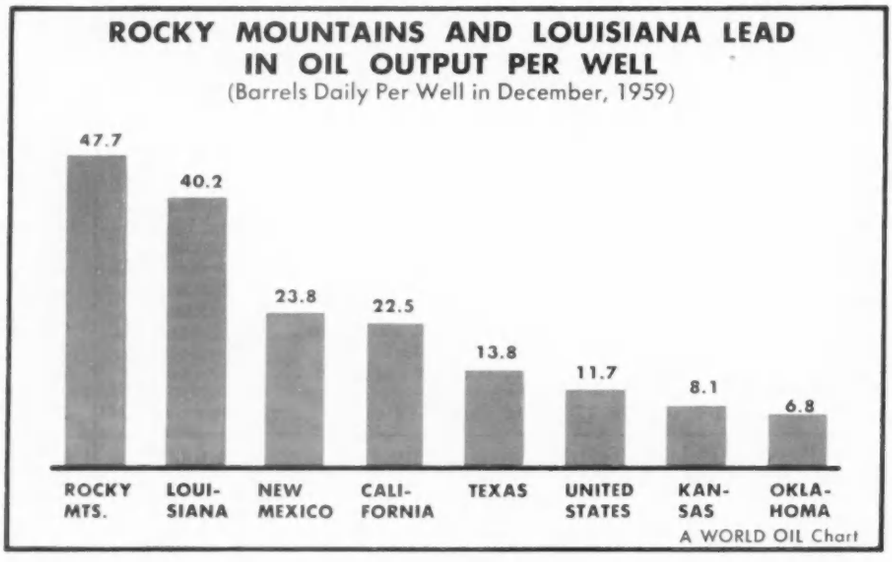
South Louisiana also holds the nation's offshore depth record, with Hunt Oil Company's gas condensate producer from 16,840 feet in the Coon Point field, Ship Shoal area, off the Louisiana Coast, completed in 1957.

Regional Producing Depth Records in the United States

State or District	Bottom of Pay (Feet)	Year Drilled	Wells and Location	Producing Formation	Production
S. La.-Inshore	**20,502**	1956	Richardson & Bass et al's Humble-LL&E 1-L, Plaquemines Parish, Lake Washington field; originally produced from 21,465 feet; later was plugged back to 20,745 feet; then recompleted in 1959 at 20,502 feet	Miocene	Oil
Oklahoma	**16,912**	1957	British American's Krieger 1, Knox field, Stephens County	Ordovician	Cond.
S. La.-Offshore	**16,840**	1957	Hunt Oil's No. 2 State Lease 758, bkl 39, Coon Point field, Ship Shoal area	Miocene	Cond.
Wyoming	**16,472**	1957	Pure Oil's Badwater Unit 1, wildcat, Natrona County	U. Cretaceous	Gas
Tex. Gulf Coast	**16,264**	1959	Pure Oil Co.'s Houston Farms Dev. Co. 1, Green's Lake, Galveston County	Basal Frio	Cond.
California	**15,530**	1949	Standard of California's Mushrush 5, Wasco field, Kern County	Ecoene	Oil
West Texas	**15,324**	1953	Phillips Petroleum's Odom 1-A, Puckett field, Pecos County	Ellenburger	Cond.
Mississippi	**15,256**	1958	Gulf's Well 1-ZB, Soso Unit, tract 28-7, Soso field, Jasper County	Cotton Valley	Oil
N. Mex.-S.E.	**15,025**	1955	Continental's Bell Lake Unit 1-a, Bell Lake field, Lea County	Devonian	Gas
S.W. Texas	**14,479**	1956	Amerada's Craig 1, Lowe Ranch field, McMullen County	Edwards	Cond.
N. Tex. Pan.	**12,884**	1959	Standard of Texas' McAdams 2, Grayson County	Simpson, Ord.	Cond.
North Dakota	**12,666**	1958	Amerada's H.H. Shelvik Tract 1 #1, wildcat, McKenzie County	Silurian	Oil
Montana	**12,605**	1953	Sun & Phillips' Dynneson 1, 32-24n-58e, Brorson field, Richland County	Red River	Oil
East Texas	**12,506**	1959	Humble's Floyd D. Elledge 1, New Hope field, Franklin County	Smackover	Cond.
Utah	**11,895**	1959	Standard of Calif.'s Uintah-Curay 3, wildcat, 5-1n-2w, Duchesne Co.	Wasatch	Oil
Alabama	**11,612**	1958	Zach Brooks Co.-Magnolia's School Ld 1, Citronelle field, Mobile Co.	Rodessa	Oil
Florida	**11,588**	1948	Humble's Lee Tidewater Cypress Lbr. 1-B, Sunniland fld., abandoned.	L.Cretaceous	Oil
Alaska	**11,543**	1959	Standard of Calif.-Richfield's Swanson River Unit, No. 34-10	Hemlock, Eoc.	Oil
N. Louisiana	**11,310**	1953	A.J. Hodges' Pardee-Callaway et al 1, Ivan field, Webster Parish	Smackover	Cond.
Colorado	**10,256**	1959	California Co.'s Bald Creek 1, wildcat, 17-7s-90w, Garfield County	Mancos	Gas
Arkansas	**9,484**	1957	Phillips et al's Talley B-1, Plainfield field, Columbia County	Cotton Valley	Oil
N. Mex. N.W.	**9,300**	1950	El Paso Natural's Ute 4, Baker Creek field, San Juan County	Paradox	Gas
South Dakota	**8,691**	1954	Shell Oil's State 1-A, Buffalo field, Harding County	Red River	Oil
Pennsylvania	**8,420**	1958	Royal Rhodes et al #1 by Felmont Oil Corp. & Peoples Natural Gas Co., Jenners Township, Somerset County	Oriskany	Gas
W. Virginia	**8,410**	1946	Ohio Oil's Kuykendall et al 1, Canaan Valley field, Tucker County	Oriskany	Gas
Michigan	**7,760**	1941	Gulf Refining's Bateson 1, Monitor Twp., Bay County (Abandoned)	Salina	Gas
Nebraska	**7,419**	1956	R.W. McDowell, Jr's State 778-1, McDowell field, Kimball County	Dakota "J"	Oil
Nevada	**7,360**	1955	Shell's Eagle Springs Unit 15-35, Eagle Springs field, Nye County	Tertiary	Oil
Maryland	**7,100**	1953	Snee & Eberly's McCullough Heirs 1, Garrett County	Chert	Gas
Kansas	**6,512**	1959	Westhoma Oil Co's., Long 1, Wide Awake field, 5-35s-34w, Seward Co.	Chester	Oil
Virginia	**6,158**	1954	Clinchfield Coal's Std. Banner Coal 152, Ervington dist., Dickenson Co.	Silurian	Gas
Ohio	**5,790**	1959	Ohio Fuel Gas-East Ohio Gas-Wiser Oil's F. Smith 1-A Hinckley Tp., Medina County	Cambro-Ord.	Gas
Arizona	**5,589**	1959	Tex. Pac. Coal & Oil's #1 Navajo Tr. 138, wildcat, 11-40n-28e, Apache Co.	Miss.	Oil
Kentucky	**5,373**	1957	United Fuel Gas's Kentland 67, Big Sandy field, Pike County	Devonian	Gas
Illinois	**5,338**	1959	Texaco's H. Silverman 16, Aden Consol. pool, Wayne County	Dutch Creek	Oil
New York	**5,215**	1942	E. Kent Kane's Robert Lewis 1, W. Union Twp., Steuben County	Oriskany	Gas
Washington	**4,135**	1957	Sunshine Mining's J.W. Tanner-Medina 1, Grays Harbor County	Oligocene	Oil
Tennessee	**3,107**	1954	Greenup-David et al's Coal Creek 1, Briceville field, Anderson County	Chattanooga	Gas
Indiana	**3,093**	1953	Hartman & Jordan's Comm. Albert Aldrich & J.C. Ellis 1, Welborn North field, Posey County	McClosky	Oil
Missouri	**1,444**	1940	Cities Service's Jim Cook 1, Tarkio field, Atchison County	Bartlesville	Oil

More producing oil wells being operated





U.S. PRODUCING oil wells experienced a higher growth rate than normal during 1959. As a result, more wells were being operated in the nation at the end of the year than ever before.

WORLD OIL surveys of oil companies and state oil agencies reveal that at the end of 1959 there were 589,533 domestic oil producing wells, 15,018 more than were operating at the close of 1958. This was the largest net increase since 1957, and the fourth largest in the history of the industry.

The higher growth rate occurred despite a five-well decrease in new completions of new oil wells to 24,043 in 1959. However, only 9,025 wells were abandoned or idled last year, the smallest number in four years, and the third smallest total in the post war era. This significant drop in abandonments more than made up for the slight decrease in new completions, thus resulting in the larger net increase.

In contrast, WORLD OIL figures show that a sharp increase in abandonments slowed the growth rate in producing wells during the previous two years. In 1957, there were only 8,769 net wells added to the nation's total, with 18,750 abandonments. In 1958, a net total of 10,972 wells were added, with 13,076 abandonments.

Output per well increases. Each well in the U.S. produced an average of 12.1 barrels daily during 1959, up three-tenths of a barrel from 1958. This was the first increase in per-well production since the peak of 13.3 barrels per well was reached in 1956.

U. S. Producing Oil Wells and Daily Output Per Well, by Years

Sources: Producing wells and output from Bureau of Mines except as noted. Wells completed from WORLD OIL and predecessor, The Oil Weekly, except 1918-1920 from Bureau of Mines. Output per well obtained by dividing daily average U. S. production for year by average number between wells producing Jan. 1 and Dec. 31.

YEAR	Wells Producing at Year End	Changes During Year: Wells Completed	Changes During Year: *Wells Abandoned	Changes During Year: †Net Gain in Wells	Bbls. Prod. per Well per Day
1918	203,375	17,860			
1919	227,000	21,041	—2,584	23,625	4.8
1920	251,000	24,278	278	24,000	5.0
1921	274,500	14,715	—8,785	23,500	4.9
1922	284,880	17,790	7,410	10,380	5.7
1923	290,100	16,182	10,962	5,220	6.6
1924	299,100	14,707	5,707	9,000	6.2
1925	306,100	17,029	10,029	7,000	6.5
1926	318,600	18,626	6,126	12,500	6.8
1927	323,300	14,382	9,682	4,700	7.7
1928	327,800	12,348	7,848	4,500	7.6
1929	328,200	15,362	14,962	400	8.4
1930	331,070	11,693	8,823	2,870	7.5
1931	315,850	7,011	22,231	—15,220	7.2
1932	321,500	10,530	4,880	5,650	6.7
1933	326,850	8,070	2,720	5,350	7.7
1934	333,070	13,119	6,899	6,220	7.5
1935	340,990	15,418	7,498	7,920	8.1
1936	349,450	18,704	10,244	8,460	8.7
1937	363,030	23,115	9,535	13,580	9.8
1938	369,640	19,106	12,496	6,610	9.1
1939	380,390	17,734	6,984	10,750	9.2
1940	389,010	19,843	11,223	8,620	9.6
1941	399,960	19,590	8,640	10,950	9.7
1942	404,840	10,977	6,097	4,880	9.4
1943	407,170	9,887	7,557	2,330	10.2
1944	412,220	13,502	8,452	5,050	11.2
1945	415,750	13,944	10,414	3,530	11.3
1946	421,460	16,087	10,377	5,710	11.3
1947	426,280	17,613	12,793	4,820	12.0
1948	437,880	22,197	10,597	11,600	12.8
1949	448,680	21,415	10,615	10,800	11.4
1950	465,870	23,775	6,585	17,190	11.8
1951	474,990	23,532	14,412	9,120	13.1
1952	488,520	23,371	9,841	13,530	13.0
1953	498,940	25,251	14,831	10,420	13.1
1954	511,200	28,063	15,803	12,260	12.6
1955	524,010	30,474	17,664	12,810	13.2
1956	551,170	30,641	3,481	27,160	13.3
1957	569,273	27,519	9,416	18,103	12.8
1958	574,905	24,048	18,416	5,632	11.7
1958‡	574,515	24,048	13,076	10,972	11.8
1959‡	589,533	24,043	9,025	15,018	12.1

* Wells abandoned or shut in. Minus sign (—) indicates shut in wells put on production. † Minus sign (—) indicates decrease in producing wells. ‡ WORLD OIL compilation.

U. S. Wells Producing Crude Oil and Lease Condensate, Methods of Producing, and Average Output Per Well, by States and Districts, at End of 1959

Data include only wells producing crude oil and lease condensate, handled as crude. Figures do not include inactive or shut-in wells, gas wells, or gas-condensate wells yielding condensate production through operation of plants. Data compiled by WORLD OIL, with cooperation of state conservation departments and other sources. Production is for December 1959, from API weekly reports.

STATE or DISTRICT	CONDENSATE WELLS			CRUDE OIL WELLS					TOTAL CRUDE OIL AND CONDENSATE WELLS		
		Bbls. Daily Produced					Bbls. Daily Produced			Bbls. Daily Produced	
	Wells	Total	Per Well	Flowing	Artificial Lift	Total Wells	Total	Per Well	Wells	Total	Per Well
Alabama				**29**	**244**	**273**	**15,800**	**57.9**	**273**	**15,800**	**57.9**
Alaska				**5**	.....	**5**	**400**	**80.0**	**5**	**400**	**80.0**
Arizona				**1**	.....	**1**	**185**	**185.0**	**1**	**185**	**185.0**
Arkansas	**49**	**250**	**5.1**	**178**	**5,881**	**6,059**	**58,850**	**330.6**	**6,108**	**59,100**	**260.4**
California	*			***1,115**	**36,101**	**37,216**	**837,700**	**22.5**	**37,216**	**837,700**	.....
Colorado	†			**382**	**1,701**	**2,083**	**129,000**	**61.9**	**2,083**	**129,000**	**61.9**
Florida				.....	**11**	**11**	**1,100**	**100.0**	**11**	**1,100**	**100.0**
Illinois				**128**	**38,736**	**38,864**	**218,000**	**5.6**	**38,864**	**218,000**	**5.6**
Indiana				**169**	**5,303**	**5,472**	**31,500**	**5.8**	**5,472**	**31,500**	**5.8**
Kansas				**243**	**39,921**	**40,164**	**325,500**	**8.1**	**40,164**	**325,500**	**9.1**
Kentucky				**19**	**21,137**	**21,156**	**65,500**	**3.1**	**21,156**	**65,500**	**3.1**
Louisiana	**3,224**	**118,137**	**36.6**	**9,280**	**13,805**	**23,085**	**928,463**	**40.2**	**26,309**	**1,046,600**	**39.8**
North Louisiana	1,008	5,879	5.8	1,683	10,801	12,484	107,721	8.6	13,492	113,600	8.4
South Louisiana	2,216	112,258	50.6	7,597	3,004	10,601	820,742	77.4	12,817	933,000	72.8
Michigan				**59**	**4,332**	**4,391**	**33,900**	**7.7**	**4,391**	**33,900**	**7.7**
Mississippi	**400**	**5,011**	**12.5**	**383**	**2,326**	**2,619**	**141,189**	**53.9**	**3,019**	**146,200**	**48.4**
Missouri				.....	**95**	**95**	**85**	**0.9**	**95**	**85**	**0.9**
Montana	†			**331**	**3,375**	**3,706**	**80,500**	**21.7**	**3,706**	**80,500**	**21.7**
Nebraska	†			**21**	**1,473**	**1,494**	**63,400**	**42.4**	**1,494**	**63,400**	**42.4**
Nevada				.....	**2**	**2**	**100**	**50.0**	**2**	**100**	**50.0**
New Mexico	**336**	**6,452**	**8.1**	**4,530**	**7,657**	**12,187**	**289,548**	**23.8**	**12,523**	**296,000**	**23.6**
Northwest New Mexico	†			208	965	1,173	34,148	29.1	1,173	34,148	29.1
Southeast New Mexico	336	6,452	19.2	4,322	6,692	11,014	255,400	23.2	11,350	261,852	23.1
New York				.....	**19,275**	**19,275**	**5,300**	**0.3**	**19,275**	**5,300**	**0.3**
North Dakota				**392**	**988**	**1,380**	**59,600**	**43.2**	**1,380**	**59,600**	**43.2**
Ohio				**160**	**14,768**	**14,928**	**11,800**	**0.8**	**14,928**	**11,800**	**0.8**
Oklahoma	†			**2,987**	**78,128**	**81,115**	**550,200**	**6.8**	**81,115**	**550,200**	**6.8**
Pennsylvania				.....	**67,580**	**67,580**	**16,400**	**0.2**	**67,580**	**16,400**	**0.2**
South Dakota				.....	**11**	**11**	**400**	**36.4**	**11**	**400**	**36.4**
Tennessee				.....	**30**	**30**	**15**	**0.5**	**30**	**15**	**0.5**
Texas	**5,241**	**80,902**	**15.4**	**47,366**	**138,298**	**185,664**	**2,560,898**	**13.8**	**190,905**	**2,641,800**	**13.8**
Dist. 1: South Central	99	2,774	28.0	352	7,569	7,921	43,026	5.4	8,020	45,800	5.7
Dist. 2: Middle Gulf	984	9,217	9.4	3,254	2,362	5,616	109,783	19.5	6,600	119,000	18.0
Dist. 3: Upper Gulf	1,272	37,556	.....	4,567	8,187	12,754	333,344	26.1	14,026	370,900	26.4
Dist. 4: Lower Gulf-S.W.	802	9,640	.....	4,781	7,011	11,792	179,660	15.2	12,594	189,300	15.0
Dist. 5: East Central	121	395	.....	319	2,749	3,068	26,005	8.5	3,189	26,400	8.3
Dist. 6: Northeast	645	9,250	.....	1,914	3,306	5,220	106,750	20.5	5,865	116,000	19.8
Dist. 6: East Texas Field	.....	.....	.....	9,609	9,308	18,917	140,700	7.4	18,917	140,700	7.4
Dist. 7-B: North Central	66	300	.....	2,310	13,822	16,132	127,900	7.9	16,198	128,200	7.9
Dist. 7-C: West Central	154	3,650	.....	2,631	5,240	7,871	124,650	15.8	8,025	128,300	16.0
Dist. 8: West	293	5,010	.....	15,605	36,324	51,929	1,056,390	20.3	52,222	1,061,400	20.3
Dist. 9: North	523	2,100	.....	1,681	30,443	32,124	198,800	6.2	32,647	200,900	6.2
Dist. 10: Panhandle	282	1,010	.....	343	11,977	12,320	107,890	8.8	12,602	108,900	8.6
Utah	†			**346**	**317**	**663**	**113,700**	**171.5**	**663**	**113,700**	**171.5**
Virginia				.....	.....	‡	‡	.....	‡	‡	.....
Washington				**1**	.....	**1**	**15**	**15.0**	**1**	**15**	**15.0**
West Virginia				.....	**12,885**	**12,885**	**5,900**	**0.5**	**12,885**	**5,900**	**0.5**
Wyoming	†	**768**	.....	**489**	**6,629**	**7,118**	**345,232**	**48.5**	**7,118**	**346,000**	**48.6**
Other States				.....	.....	.....	.....	.....	§	§	.....
Total U.S., End of 1959	**9,250**	**211,520**	**22.8**	**68,614**	**520,919**	**589,533**	**6,890,180**	**11.7**	**598,783**	**7,101,700**	**11.9**
⁋Total U.S., End of 1958	8,434	174,366	20.7	68,125	506,390	574,515	6,930,834	12.1	582,949	7,105,200	12.2

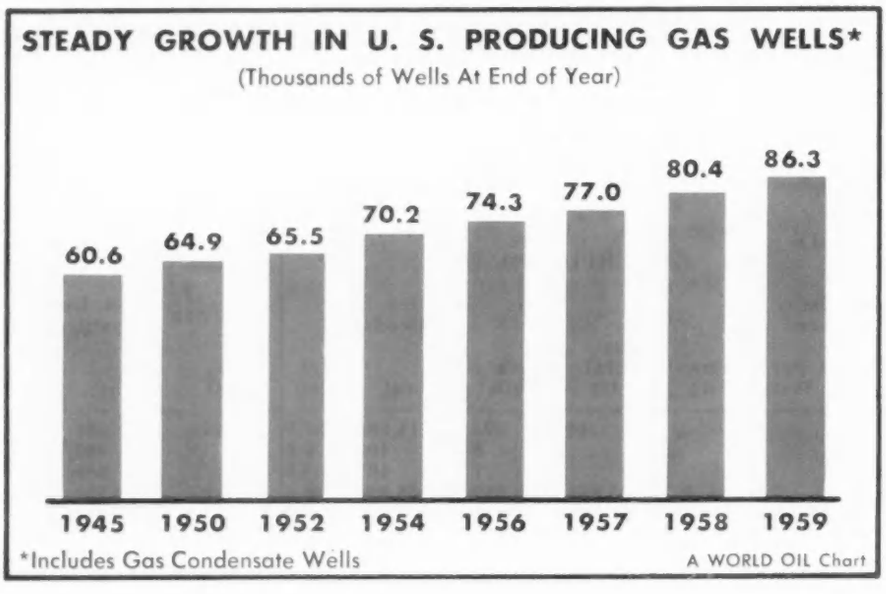
* California condensate wells are included with flowing oil wells.

† Colorado, Montana, Nebraska, Northwest New Mexico, Oklahoma, Utah, and Wyoming have some gas-condensate wells, but data are not available, being included in gas wells.

‡ No data on Virginia available for 1959, although the state produced about 4,000 barrels of crude oil in 1958, an average of 11.0 barrels daily, from an unreported number of wells.

§ No producing wells or production reported in 1959.

⁋ Data by states in WORLD OIL Feb. 15, 1959, page 144.



Producing gas wells at new high and still increasing

THE STEADY post war growth in the number of U.S. producing gas and gas condensate wells is expected to continue in 1960. Two contributing factors will be:

- WORLD OIL's forecast that 110, or 2.2 percent more gas and gas condensate wells will be drilled during the year than in 1958, for a record total of 5,041 new wells.
- Marketed production of natural gas is expected to increase 3.5 percent to 11.8 trillion cubic feet in 1960.

The number of operating gas and gas condensate wells reached a new high of 86,256 at the end of 1959. However, the net increase in 1959 was somewhat lower than in 1958—2,928 wells, compared with a record net gain of 4,459 the previous year.

Reason: Although the 4,931 new gas wells completed during 1959 were only slightly under the 1958 total, last year's 2,003 abandonments nearly quadrupled the 1958 total of 583. Thus, the net gain dropped proportionately.

Even so, the 2,928 producing wells added last year represented the largest net gain in the history of the industry, with the exception of 1958. The same is true for the 4,931 new gas and gas condensate wells drilled during 1959.

Leading gas states. There were 77,006 gas wells operating in the U.S. at the end of 1959, with seven states accounting for 84 percent of the total.

Pennsylvania continued as the leading state with 16,350 gas wells producing at year's end, up 50 wells from the same date in 1958. West Virginia was second with 13,800 wells, down 600 from the previous year, followed by Texas with 11,582 wells, up 1,287 over 1958.

U.S. Producing Gas Wells and Daily Output Per Well, by Years

(Including gas-condensate wells)

Sources: Bureau of Mines except as noted. Output per well obtained by dividing daily average gross production from gas wells for year by average number between wells producing Jan. 1 and Dec. 31.

YEAR	Wells Producing at Year End	Changes During Year: [1]Wells Completed	[2]Wells Abandoned	[3]Net Gain in Wells	[4]Mcf. Prod. Per Well Per Day
1929	[5]53,545	3,107	6	6	6
1930	[5]55,020	2,971	1,496	1,475	6
1931	[5]55,756	2,067	1,331	736	6
1932	[5]54,156	1,079	2,679	—1,600	6
1933	[5]53,660	1,190	1,686	—496	6
1934	54,130	1,496	1,026	470	6
1935	53,790	1,802	2,142	—340	6
1936	54,500	2,375	1,665	710	75
1937	55,050	2,732	2,182	550	81
1938	53,770	2,143	3,423	—1,280	79
1939	55,530	2,030	270	1,760	92
1940	53,880	2,265	3,915	—1,650	105
1941	55,500	3,279	1,659	1,620	125
1942	56,150	2,790	2,140	650	142
1943	57,200	2,390	1,340	1,050	155
1944	58,780	3,078	1,498	1,580	172
1945	60,600	3,192	1,372	1,820	178
1946	62,740	3,562	1,422	2,140	169
1947	63,676	3,720	2,784	936	163
1948	64,212	3,312	2,776	536	196
1949	63,346	3,499	4,365	—866	214
1950	64,900	3,480	1,926	1,554	239
1951	65,100	3,542	3,342	200	273
1952	65,450	3,693	3,343	350	286
1953	68,223	3,806	1,033	2,773	291
1954	70,192	4,219	2,250	1,969	291
1955	71,475	4,169	2,886	1,283	303
1956	74,261	4,495	1,709	2,786	311
1956[1]	76,308	4,495	1,989	2,506	302
1957	77,041	4,622	1,842	2,780	316
1957[1]	78,869	4,622	2,061	2,561	308
1958	80,400	5,042	1,683	3,359	319
1958[1]	83,328	5,042	583	4,459	309
1959[1]	86,256	4,931	2,003	2,928	307

[1] WORLD OIL data. [2] Wells abandoned or shut in Minus sign (—) indicates shut in wells put on production. [3] Minus sign (—) indicates decrease in producing wells. [4] Thousand cubic feet from gas wells; excludes gas from oil wells. [5] Average during year. [6] Not available.

U. S. Gas and Gas-Condensate Wells Producing at End of Year, 1958 and 1959

Data include: Wells producing gas exclusively; wells producing condensate for handling on leases and not in plants; no wells producing crude oil; no shut in wells.

State or District	END OF 1959: Gas Wells	END OF 1959: Gas-Cond. Wells	END OF 1958: Gas Wells	END OF 1958: Gas-Cond. Wells
Alabama	5			
Arkansas	309	49	372	
California	435	*	395	*
Colorado	768	†	712	†
Illinois	89		103	
Indiana	61		369	
Kansas	6,343		6,256	
Kentucky	4,500		4,450	
Louisiana	2,730	3,224	2,350	2,776
North Louisiana	2,486	1,008	2,261	863
South Louisiana	244	2,216	69	1,913
Michigan	382		502	
Mississippi	613	400	218	389
Missouri	4		5	
Montana	621	†	601	†
Nebraska	61	†	63	†
New Mexico	4,815	3363	4,162	745
Northwest N.M.	4,063	†	3,219	466
Southeast N.M.	752	336	943	279
New York	825		1,200	
Ohio	6,930		6,870	
Oklahoma	5,112	†	4,801	†
Pennsylvania	16,350		16,300	
Tennessee	30		16	
Texas	11,582	5,241	10,295	4,524
Dist. 1: S. Central	141	99	87	70
Dist. 2: Mid. Gulf	1,228	984	1,044	867
Dist. 3: U. Gulf	955	1,272	682	1,187
Dist. 4:L.Gulf-S.W.	1,936	802	1,735	665
Dist. 5: E. Central	75	121	69	95
Dist.-6: Northeast	1,219	645	1,294	621
Dist. 7-B: N. Cent.	466	66	384	62
Dist. 7-C: W. Cent.	148	154	74	132
Dist. 8: West	284	293	282	224
Dist. 9: North	209	523	116	389
Dist. 10: Panhandle	4,921	282	4,528	212
Utah	63	†	49	†
West Virginia	13,800		14,400	
Wyoming	388	†	335	†
‡Miscellaneous	190		70	
Total U.S.	77,006	9,250	74,894	8,434

* California condensate wells are included in another table in flowing oil wells.

† Colorado, Montana, Nebraska, Northwest New Mexico, Oklahoma, Utah, and Wyoming have some gas-condensate wells, but data not available, being included in gas wells.

‡ Alabama, Arizonia, Maryland, North Dakota, Virginia.

Geophysical activity at 13-year low

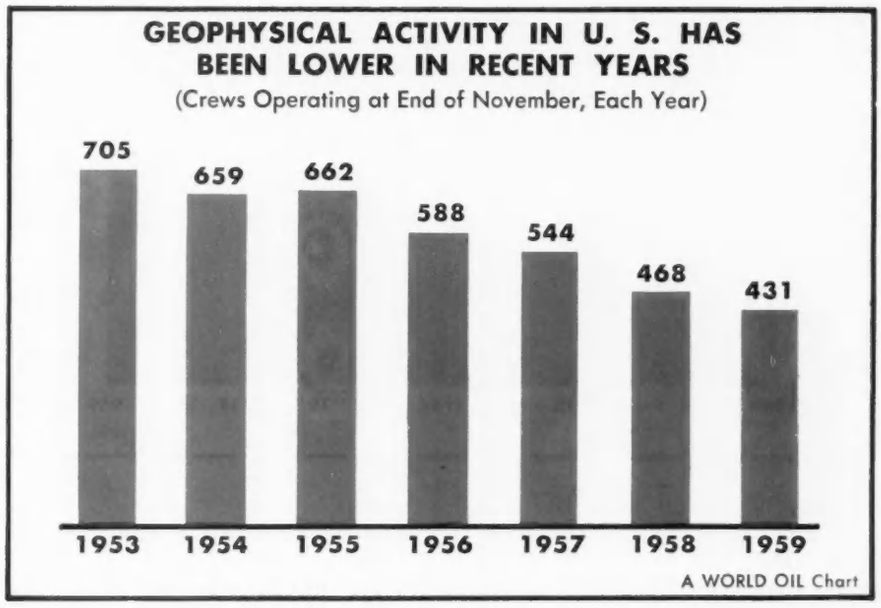
COMPARISON of November's end reports reveals that U.S. geophysical activity extended its downward trend to seven years during 1959. In fact, last November's total of 431 crews not only was down 40 crews or 8 percent from the same date in 1958, it also marked the lowest total since 1946.

Since reaching a peak of 722 geophysical crews working at the end of 1952, the November 30 totals have dropped steadily every year with the exception of 1955, when activity increased slightly. The 431 crews working last November 30 represented a 40.3 percent drop from the 1952 total.

The effects of such incentive killers as oversupply, excessive productive capacity, imports and decreasing profit margins on crude were reflected in every phase of U.S. geophysical activity last year. Seismic operations decreased 7 percent, from 420 crews working on November 30, 1958, to 391 on the same date last year.

Gravity crews totaled 37 at last November's end, down 12 percent from the previous year's total of 42.

During the 1952-1959 period, seismic crew totals dropped 38.9 percent, from 640 to 391. Gravity crews decreased 53.8 percent, from 80 to 37.



New areas show increases

AREAS OUTSIDE the nine leading exploration states continued to increase their share of total U.S. geophysical activity, accounting for 16.3 percent of all crews working on November 30. In comparison, these areas accounted for 11 percent of the U.S. total in 1956, 11.1 percent in 1957, and 12.8 percent in 1958.

Decreased geophysical activity in the leading states resulted from sharp declines in Utah, Louisiana and Arkansas. Comparing November's end 1958 with the same date in 1959, Utah reported a drop of 25 crews last year, from 42 to 17; Louisiana was down 19 crews, from 77 to 58; Arkansas was down 9 crews, from 14 to 5. Also, Texas reported a 4.7 percent drop, from 150 crews to 143 and Colorado activity decreased from 16 crews to 14.

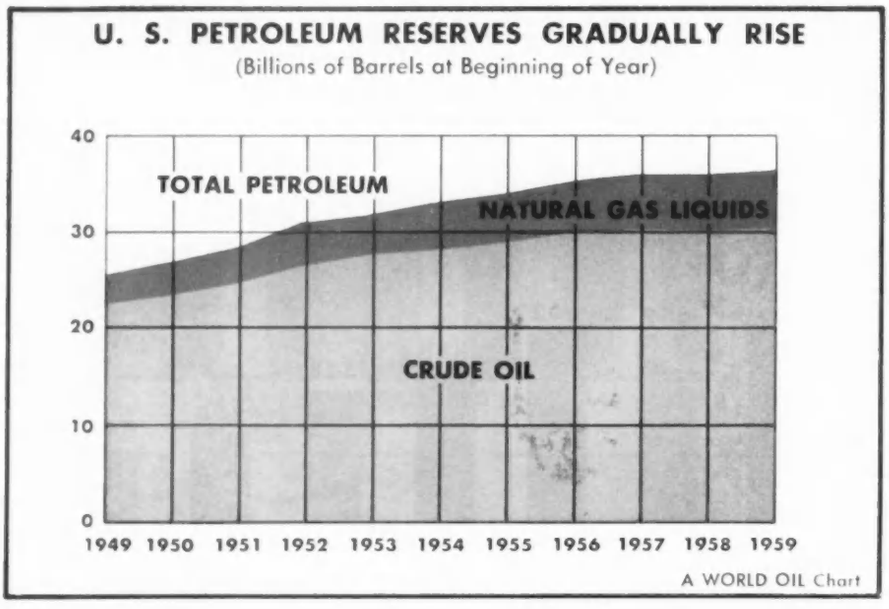
Three of the remaining major exploration states (Mississippi, New Mexico and Oklahoma) reported slight increases in activity, while Wyoming increased 9 crews, from 23 to 32.

U. S. Geophysical and Core Drilling Crews Operating at End of November, 1959 and 1958

(Source: Interstate Oil Compact Commission)

	GEOPHYSICAL CREWS								CORE DRILL CREWS		Total Geophysical and Core Drill	
	Seismic		Gravity		Magnetometer		Total Geophysical					
STATE	1959	1958	1959	1958	1959	1958	1959	1958	1959	1958	1959	1958
Alabama	1	3	3	...	...	...	4	3	...	...	4	3
Alaska	8	...	...	...	...	...	8	...	1	...	9	...
Arizona	2	...	2	...	...	...	4	...	...	...	4	...
Arkansas	5	14	...	...	...	...	5	14	...	...	5	14
California	10	6	1	1	...	...	11	7	...	...	11	7
Colorado	13	16	1	...	...	...	14	16	...	...	14	16
Florida	3	5	...	1	...	...	3	6	1	1	4	7
Georgia	...	...	1	...	...	...	1	...	1	...	2	...
Idaho	...	2	...	2	...	...	...	4	...	1	...	5
Illinois	...	...	...	...	...	...	...	...	9	5	9	5
Indiana	...	...	1	...	...	...	1	...	3	2	4	2
Kansas	11	6	1	1	1	1	13	8	...	1	13	9
Louisiana	56	72	2	5	...	...	58	77	...	...	58	77
N. Louisiana	1	10	...	2	...	...	1	12	...	...	1	12
S. Louisiana	55	62	2	3	...	...	57	65	...	...	57	65
Michigan	1	...	2	2	...	...	3	2	...	1	3	3
Mississippi	33	29	2	4	...	...	35	33	1	2	36	35
Montana	11	12	...	...	...	...	11	12	...	...	11	12
Nebraska	3	6	...	...	...	...	3	6	...	...	3	6
Nevada	...	2	...	1	...	...	...	3	...	...	...	3
New Mexico	26	28	7	4	1	1	34	33	...	...	34	33
North Dakota	7	8	1	1	...	...	8	9	...	...	8	9
Oklahoma	21	20	...	...	...	...	21	20	...	...	21	20
South Dakota	2	...	...	...	...	...	2	...	...	...	2	...
Texas	132	134	10	14	1	2	143	150	5	6	148	156
Texas (North)	8	11	1	2	...	...	9	13	1	...	10	13
Texas (East)	14	14	...	1	...	...	14	15	1	1	15	16
Texas (S. East)	32	32	3	1	...	...	35	33	...	...	35	33
Texas (S. West)	33	24	2	1	...	...	35	25	...	...	35	25
Texas (W. Cent.)	2	3	...	...	...	...	2	3	...	1	2	4
Texas (West)	43	50	4	9	1	2	48	61	3	4	51	65
Utah	15	34	2	6	...	2	17	42	...	5	17	47
Wyoming	31	23	1	...	...	...	32	23	...	...	32	23
Total	391	420	37	42	3	6	431	468	21	24	452	492

Oil reserves at all-time high



Estimated Proved Reserves of Crude Oil, Natural Gas Liquids, and Total Liquid Hydrocarbons in United States, by Years

(Sources: American Petroleum Institute and American Gas Association.)
Note: For prior years, see WORLD OIL, February 15, 1959, page 160.
(Thousands of Barrels)

Year and Item	CHANGES IN RESERVES DURING YEAR: (ADDITION) RESERVES PROVED: Revisions of Prior Estimates	Extensions to Old Pools	Total Revisions and Extensions	New Pools Discovered	Total New Reserves Proved	(Deduct) Production During Year	(Net Change) Increase or Decrease	Estimated Proved Reserves at End of Year	Ratio, Year End Reserves to Year's Prod. (Year's Supply)
Crude Oil									
1945					1,870,971	1,713,655	+ 157,316	19,941,846	11.6
1946	1,254,705	1,158,923	2,413,628	244,434	2,658,062	1,726,348	+ 931,714	20,873,560	12.1
1947	749,278	1,269,862	2,019,140	445,430	2,464,570	1,850,445	+ 614,125	21,487,685	11.6
1948	1,958,853	1,439,873	3,398,726	396,481	3,795,207	2,002,448	+1,792,759	23,280,444	11.6
1949	603,566	1,693,862	2,297,428	890,417	3,187,845	1,818,800	+1,369,045	24,649,489	13.6
1950	663,378	1,334,391	1,997,769	564,916	2,562,685	1,943,776	+ 618,099	25,268,398	13.0
1951	1,776,110	2,248,588	4,024,698	389,256	4,413,954	2,214,321	+2,199,633	27,468,031	12.4
1952	743,729	1,509,131	2,252,860	496,428	2,749,288	2,256,765	+ 492,523	27,960,554	12.4
1953	1,264,832	1,439,618	2,704,450	591,680	3,296,130	2,311,856	+ 984,274	28,944,828	12.5
1954	537,788	1,749,443	2,287,231	585,806	2,873,037	2,257,119	+ 615,918	29,560,746	13.1
1955	696,114	1,697,653	2,393,767	476,957	2,870,724	2,419,300	+ 451,424	30,012,170	12.4
1956	804,803	1,702,211	2,507,114	467,222	2,974,336	2,551,857	+ 422,479	30,434,649	11.9
1957	465,421	1,543,182	2,008,603	416,197	2,424,800	2,559,044	— 134,244	30,300,405	11.8
1958	954,605	1,338,908	2,293,513	314,729	2,608,242	2,372,730	+ 235,512	30,535,917	12.9
Natural Gas Liquids									
1946								3,163,219	
1947			192,237	59,301	251,538	160,782	+ 90,756	3,253,975	20.2
1948			405,874	64,683	470,557	183,749	+ 286,808	3,540,783	19.3
1949			291,211	92,565	386,776	198,547	+ 188,229	3,729,012	18.8
1950			707,879	58,183	766,062	227,411	+ 538,651	4,267,663	18.8
1951			648,197	75,494	723,991	267,052	+ 456,939	4,724,602	17.7
1952			475,170	81,668	556,838	284,789	+ 272,049	4,996,651	17.5
1953			618,047	95,922	743,969	302,698	+ 441,271	5,437,922	18.0
1954			20,830	86,520	107,350	300,815	— 193,465	5,244,457	17.4
1955			147,160	67,348	514,508	320,400	+ 194,108	5,438,565	17.0
1956			715,764	94,056	809,820	346,053	+ 463,767	5,902,332	17.1
1957			— 8,884	128,508	137,392	352,364	— 214,972	5,687,360	16.1
1958			749,956	108,250	858,206	341,548	+ 516,658	6,204,018	18.2
Total Liquid Hydrocarbons									
1946								24,036,779	
1947			2,211,377	564,731	2,776,108	2,011,227	+ 764,881	24,741,660	12.3
1948			3,804,600	461,164	4,265,764	2,186,197	+2,079,567	26,821,227	12.3
1949			2,591,639	982,982	3,574,621	2,017,347	+1,557,274	28,378,501	14.1
1950			2,705,648	623,099	3,328,747	2,171,187	+1,157,560	29,536,061	13.6
1951			4,673,195	464,750	5,137,945	2,481,373	+2,656,572	32,192,633	13.0
1952			2,728,030	578,096	3,306,126	2,541,554	+ 764,572	32,957,205	13.0
1953			3,352,497	687,602	4,040,099	2,614,554	+1,425,545	34,382,750	13.2
1954			2,308,061	672,326	2,980,387	2,557,934	+ 422,453	34,805,203	13.6
1955			2,840,927	544,305	3,385,232	2,739,700	+ 645,532	35,450,735	13.0
1956			3,222,878	561,278	3,784,156	2,897,910	+ 886,246	36,336,981	12.5
1957			2,017,487	544,705	2,562,192	2,911,408	— 349,216	35,987,765	12.4
1958			3,043,469	422,979	3,466,448	2,714,278	+ 752,170	36,739,935	13.5

* Production compiled by API and AGA committees on basis of 11 months actual and December estimated. Small variance of these figures from actual production as later reported is compensated by revision when reserves report for succeeding year is compiled.

THE U.S. OIL AND GAS industry proved up 752.2 million more barrels of new liquid hydrocarbon reserves than it produced during 1958. As a result, at the start of 1959:

- The U.S. reserve total was at a new high—36.7 billion barrels.
- At 1958 production rates, the U.S. had a 13.5-year supply of proved recoverable liquid hydrocarbon reserves—the highest ratio since 1954.

The 1958 reserve picture reflected a sharp improvement over 1957, when for the first time in 14 years, the industry proved up a smaller supply of crude oil and natural gas liquids than it produced.

Actually, compared with recent years, only an average amount of reserves were proved up during 1958 (3.46 billion barrels). However, annual production totaled 2.71 billion barrels for a four-year low, resulting in a much improved reserve picture over the previous year.

Crude oil accounted for 30.5 billion barrels of the liquid hydrocarbon reserves at the start of 1959, an increase of 235.5 million barrels over the same 1958 period. Although the increase was nominal compared with other postwar years, it was much better than the 134.2 million-barrel decrease in crude reserves during 1957.

Total natural gas liquid reserves increased 516.7 million barrels during 1958 to 6.2 billion barrels, for the largest reserve increase since 1950. This was in sharp contrast with 1957, when reserves dropped nearly 215 million barrels.

The above figures are the latest available. Reserve estimates for the end of 1959 will not become available from the American Petroleum Institute until next month.

New discoveries increase. New crude oil reserves proved up during 1958 totaled 2.61 billion barrels, an increase of 183.4 million barrels over 1957. Also, the ratio of crude oil reserves to annual production increased from 11.8-1 in 1957 to 12.9-1 at the start of 1959.

The volume of new natural gas liquids reserves proved up jumped from 137.4 million barrels in 1957 to 858.2 million barrels in 1958. This was the largest amount of new reserves found in a single year since the end of World War II.

Where petroleum reserves are located

At the start of 1959, four states accounted for 29.4 billion barrels or 80 percent of all liquid hydrocarbon reserves in the United States.

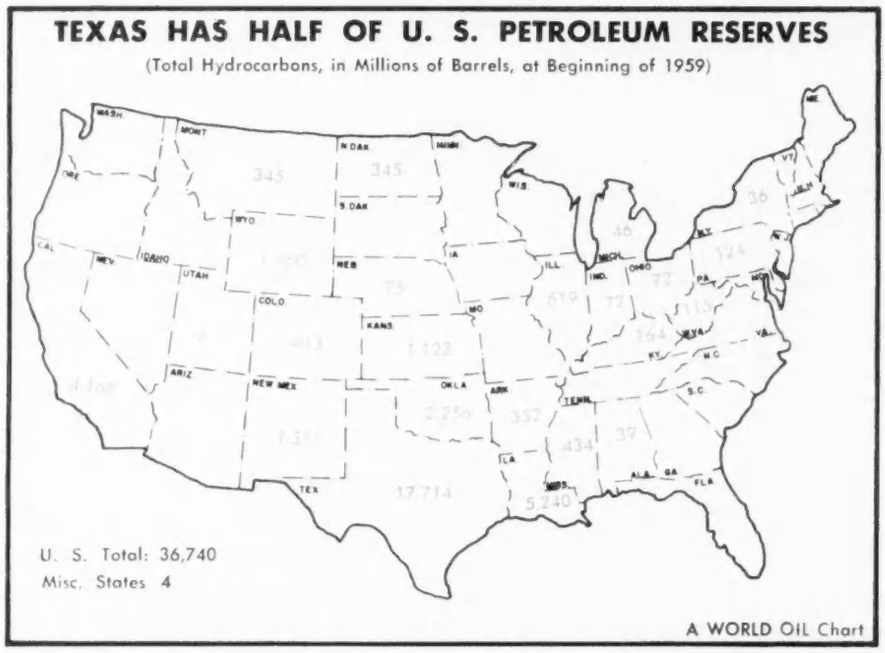
Texas, while accounting for a steadily decreasing share of the nation's reserves, still reported three times the total of the next largest state. With 17.7 billion barrels, Texas had 48.2 percent of all U.S. reserves. Three years earlier, 50.7 percent of all U.S. reserves were beneath Texas soil.

Although a distant second, Louisiana increased its share of the U.S. total from 11.8 percent to 14.3 percent over the same three-year period. At the beginning of 1959, Louisiana reported 5.2 billion barrels of liquid hydrocarbon reserves, up 363 million barrels from the same date in 1958, and more than 1 billion barrels over the beginning of 1956.

In 1956, 1957 and 1958, Louisiana increased its crude oil reserves 789 million barrels, or 24.2 percent and its natural gas liquids reserves were increased 260 million barrels, or 27.8 percent.

California reported 4.2 billion barrels of reserves at the start of 1959, up 103 million barrels over 1958. Oklahoma, with 2.3 billion barrels, was down slightly.

Wyoming, the fifth ranking state, reported 1.46 billion barrels, followed by New Mexico with 1.31 billion barrels and Kansas with 1.12 billion barrels.


TEXAS HAS HALF OF U. S. PETROLEUM RESERVES
(Total Hydrocarbons, in Millions of Barrels, at Beginning of 1959)
U. S. Total: 36,740
Misc. States 4
A WORLD OIL Chart

Estimated Proved Reserves of Crude Oil, Natural Gas Liquids and Total Liquid Hydrocarbons in U. S., by States, at End of 1958 and 1957

(Source: American Petroleum Institute)

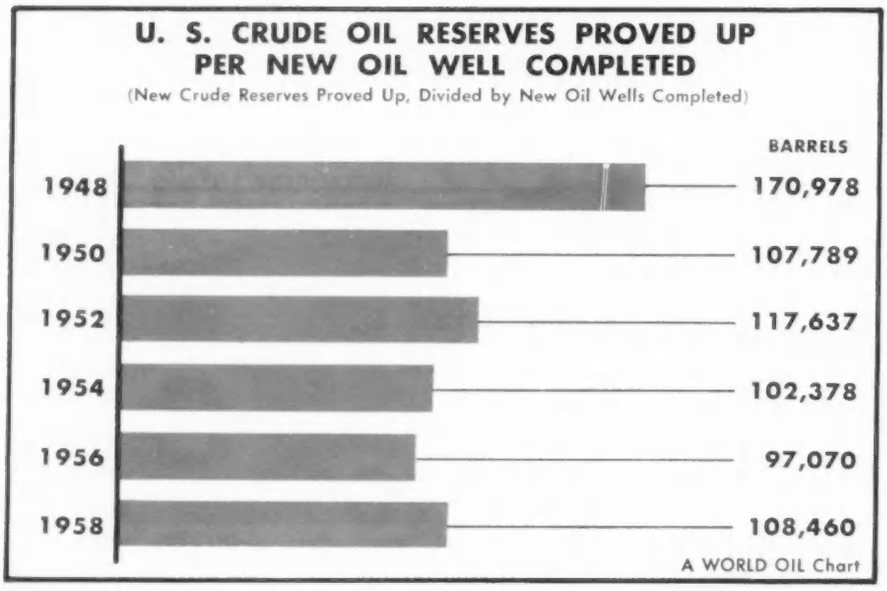
Thousands of Barrels

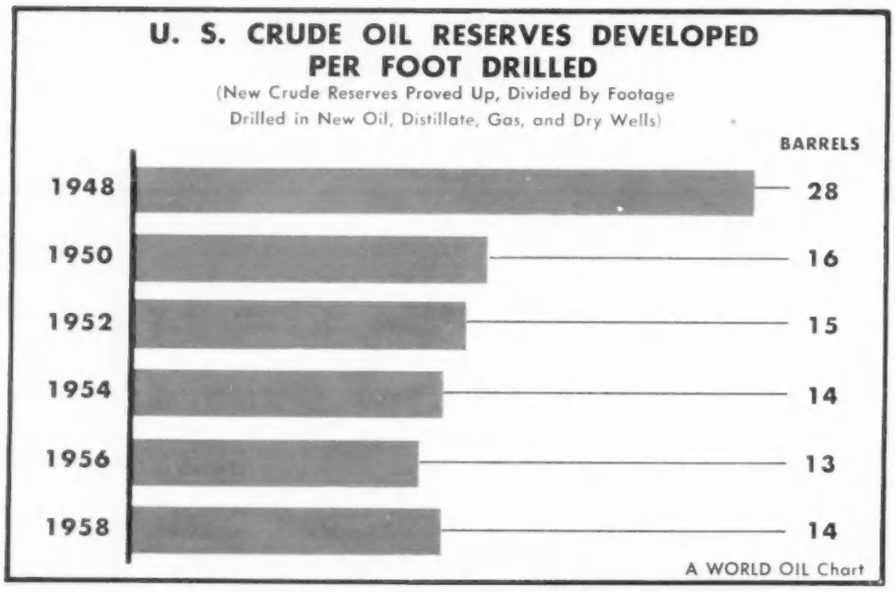
STATE	DECEMBER 31, 1958 Crude Oil	Natural Gas Liquids	Total Liquid Hydrocarbons	Percent of U.S.	DECEMBER 31, 1957 Crude Oil	Natural Gas Liquids	Total Liquid Hydrocarbons	Percent of U.S.
Alabama	38,586	.....	38,586	.10	34,409	.....	34,409	0.09
Arkansas	317,865	34,150	352,015	.96	304,959	37,140	342,099	0.95
*California	3,866,430	302,319	4,168,749	11.34	3,759,754	305,729	4,065,483	11.30
Colorado	392,060	21,268	413,328	1.13	309,939	10,965	320,904	0.89
Illinois	607,589	10,950	618,539	1.68	654,746	11,793	666,539	1.85
Indiana	71,469	119	71,588	.20	66,736	114	66,850	0.19
Kansas	922,434	199,552	1,121,986	3.05	947,484	189,155	1,136,639	3.16
Kentucky	126,357	37,472	163,829	.45	138,040	5,707	143,747	0.40
*Louisiana	4,043,993	1,195,955	5,239,948	14.26	3,857,569	1,019,198	4,876,767	13.55
Michigan	44,968	1,502	46,470	.13	49,492	1,237	50,729	0.14
Mississippi	378,688	55,182	433,870	1.18	359,550	54,401	413,951	1.15
Montana	337,799	7,497	345,296	.94	319,991	7,805	327,796	0.91
Nebraska	69,242	5,699	74,941	.20	63,059	7,135	70,194	0.19
New Mexico	894,121	417,238	1,311,359	3.57	831,744	320,548	1,152,292	3.21
New York	35,803	.....	35,803	.10	37,533	.....	37,533	0.10
North Dakota	314,079	31,239	345,318	.94	258,221	22,700	280,921	0.78
Ohio	70,809	1,618	72,427	.20	68,150	1,810	69,960	0.20
Oklahoma	1,898,128	357,507	2,255,635	6.13	1,941,521	342,643	2,284,164	6.34
Pennsylvania	119,832	3,685	123,517	.34	126,490	3,460	129,950	0.36
*Texas	14,322,216	3,391,967	17,714,183	48.22	14,555,140	3,271,617	17,826,757	49.54
Utah	198,639	14,899	213,538	.58	140,034	91	140,125	0.39
West Virginia	52,104	63,286	115,390	.31	52,545	22,912	75,457	0.21
Wyoming	1,408,717	50,876	1,459,593	3.97	1,419,718	51,165	1,470,883	4.08
†Miscellaneous	3,989	38	4,027	.02	3,581	35	3,616	0.02
Total U.S.	30,535,917	6,204,018	36,739,935	100.00	30,300,405	5,687,360	35,987,765	100.00

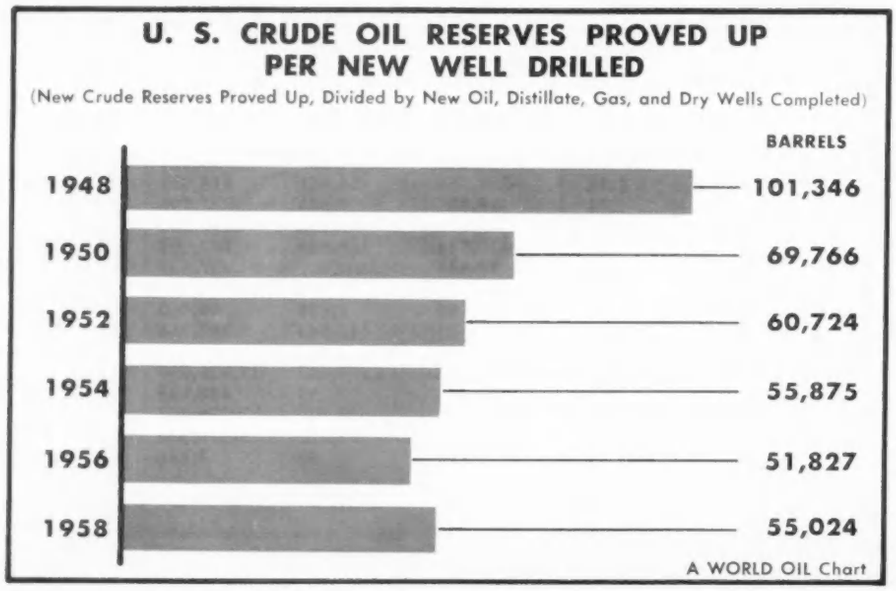
* Includes off-shore reserves.

† Miscellaneous includes: crude in Ariz., Fla., Mo., Nev., S.D., Tenn., Va., and Wash.; natural gas liquids in Ala. and Fla.

More oil found per foot drilled


U. S. CRUDE OIL RESERVES PROVED UP PER NEW OIL WELL COMPLETED
(New Crude Reserves Proved Up, Divided by New Oil Wells Completed)
BARRELS
1948 170,978
1950 107,789
1952 117,637
1954 102,378
1956 97,070
1958 108,460
A WORLD OIL Chart


U. S. CRUDE OIL RESERVES DEVELOPED PER FOOT DRILLED
(New Crude Reserves Proved Up, Divided by Footage Drilled in New Oil, Distillate, Gas, and Dry Wells)
BARRELS
1948 28
1950 16
1952 15
1954 14
1956 13
1958 14
A WORLD OIL Chart


U. S. CRUDE OIL RESERVES PROVED UP PER NEW WELL DRILLED
(New Crude Reserves Proved Up, Divided by New Oil, Distillate, Gas, and Dry Wells Completed)
BARRELS
1948 101,346
1950 69,766
1952 60,724
1954 55,875
1956 51,827
1958 55,024
A WORLD OIL Chart

FOR THE FIRST TIME in five years, the U.S. oil industry reported an increase in crude oil reserves found per oil well drilled during 1958—108,460 barrels, compared with 88,114 barrels in 1957. Also, for the first time in four years, there was an increase in barrels of oil found per foot drilled—14 barrels, compared with 11 barrels in 1957.

The reserves-drilling ratio improved despite the fact that less crude oil reserves were proved up during 1958 than in recent years, i.e., 2.6 billion barrels vs. nearly 3 billion barrels in 1956 and 2.9 billion barrels in 1955 and 1954. In fact, outside of 1957, less new reserves were added during 1958 than at any time since 1950.

Why ratio improved. Even though the new reserve additions were comparatively low, total footage drilled was even lower.

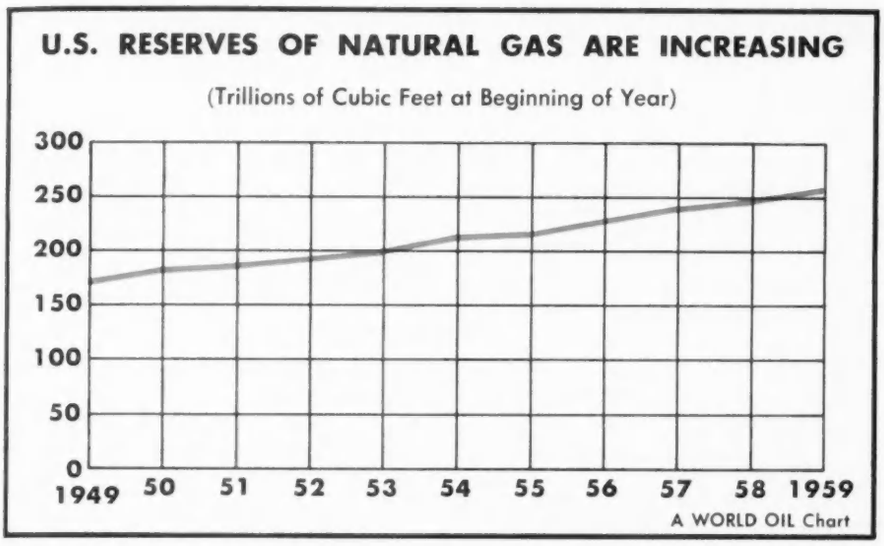
The 192.7 million feet of hole drilled during 1958 was down 11.2 percent from the previous year—the sharpest drop since World War II. Also, it was the smallest total since 1952 when 188.4 million feet of hole were drilled.

The reserves-drilling ratio increase during 1958 still left the averages far below the results of previous years. For example, the average of 14 barrels of oil found per foot drilled was only half the average during 1937-1941.

Crude Oil Reserves Developed in U. S. in Relationship to Drilling Effort

	Barrels Per Total Well Drilled	Barrels Per Foot Drilled	Barrels Per Oil Well Drilled
1937–1941	89,171	28	131,173
1942–1946	86,815	25	154,670
1947	79,287	22	139,929
1948	101,346	28	170,978
1949	84,308	23	148,860
1950	60,766	16	107,789
1951	99,032	25	187,572
1952	60,724	14	117,637
1953	68,325	17	130,535
1954	55,875	14	102,378
1955	51,999	13	94,202
1956	5',827	13	97,070
1957	46,283	11	88,114
1958	55,024	14	108,460

Total wells drilled include all new wells drilled in search of production and completed as oil, gas, distillate or dry holes. Oil wells drilled include all new wells completed as producing oil wells during the year.



Gas reserves increase while production drops

U. S. RESERVES OF NATURAL GAS increased to 22.1 times annual production in 1958 from 21.4 times output in 1957. This was the first time in 12 years that the ratio showed an increase.

The ratio improved in 1958 although less new reserves were proved up than in other recent years. For while gas finding slowed down, gas production also decreased, whereas output usually increases.

Why trend stopped. The industry reported its first drop in natural gas production in 25 years during 1958—down 17 billion cubic feet from the 11.5 trillion cubic feet produced during 1957.

Several factors contributed to the production slowdown, including availability of cheap alternative fuels to industry on the eastern seaboard, weather and the temporary curbing of pipe line construction resulting from the Memphis Decision and other federal entanglements.

However, predictions are that natural gas production will resume its annual increases during 1960, and will outgain reserve increases once again.

Reserve gains. At the beginning of 1959, the United States had an estimated proved natural gas reserve of 254.1 trillion cubic feet—nearly 100 trillion cubic feet more than was reported at the end of World War II.

Reserve figures for the beginning of 1960 are not yet available. The reserve committee of the American Gas Association does not release its annual report until March.

Outlook. High discovery rates in recent years indicate the ability of the industry to continue to find large volumes of additional reserves, provided someone exerts the leadership needed to set up a workable method of determining wellhead gas prices—and market conditions remain favorable.

In short, the continued rapid growth of the natural gas industry will depend to a great extent on whether producers are given the necessary incentives.

The discovery of 95.59 trillion cubic feet during 1954-1958 marked the most successful discovery period in history. In the preceding five-year period, 1949-1953, new reserve discoveries totaled only 75.7 trillion cubic feet.

Changes in U. S. Reserves of Natural Gas, by Years, Since 1945

Source: AGA . . . Data in millions of cubic feet, 14.65 psi at 60° F.

	CHANGES IN RESERVES DURING YEAR								
		(Add.) Reserves Proved							
YEAR	Estimated Proved Reserves Beginning of Year	Extensions and Revisions	Discoveries of New Fields and New Pools in Old Fields	Total Reserves Proved During Year (Cols.2+3)	(Add or Deduct) Net Change in Storage	(Deduct) Net Production During Year	(Net Change) Increase or Decrease (Cols. 4+ 5—6)	Estimated Proved Reserves End of Year (Cols. 1+7)	Ratio of Year-End Reserves to Year's Prod. (Year's Supply) Col. 8÷ Col. 6
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1945	.....	.....	.....	.....	.....	.....	.....	147,789,367	....
1946	147,789,367	.....	.....	17,729,152	*	4,942,617	+12,786,535	160,575,901	32.5
1947	160,575,901	7,570,654	3,410,170	10,980,824	*	5,629,811	+ 5,351,013	165,926,914	29.5
1948	165,926,914	9,769,483	4,129,089	13,898,572	+ 51,482	6,007,628	+ 7,942,426	173,869,340	28.9
1949	173,869,340	8,061,429	4,612,870	12,674,299	+ 82,746	6,245,041	+ 6,512,004	180,381,344	28.9
1950	180,381,344	9,172,381	2,877,351	12,049,732	+ 54,301	6,892,678	+ 5,211,355	185,592,699	26.9
1951	185,592,699	13,013,606	3,039,385	16,052,991	+132,751	7,966,941	+ 8,218,801	193,811,500	24.3
1952	193,811,500	8,934,470	5,411,043	14,345,513	+198,850	8,639,638	+ 5,904,725	199,716,225	23.1
1953	199,716,225	13,371,355	7,081,661	20,453,016	+516,431	9,238,540	+11,730,907	211,447,132	22.9
1954	211,447,132	4,632,309	4,966,894	9,599,203	+ 90,906	9,426,509	+ 263,600	211,710,732	22.5
1955	211,710,732	16,298,125	5,719,069	22,017,194	+ 87,637	10,118,118	+11,986,713	223,697,445	22.1
1956	223,697,445	19,214,604	5,636,476	24,851,080	+133,970	10,907,926	+14,077,124	237,774,569	21.7
1957	237,774,569	11,118,319	8,998,993	20,117,312	+179,733	11,502,359	+ 8,794,686	246,569,255	21.4
1958	246,569,255	13,388,808	5,611,098	18,999,906	+57,902	11,485,026	+ 7,572,782	254,142,037	22.1

* Not estimated.

Estimates of Proved Reserves of Natural Gas in U. S., by Years, Since 1918

(Production from Bureau of Mines)

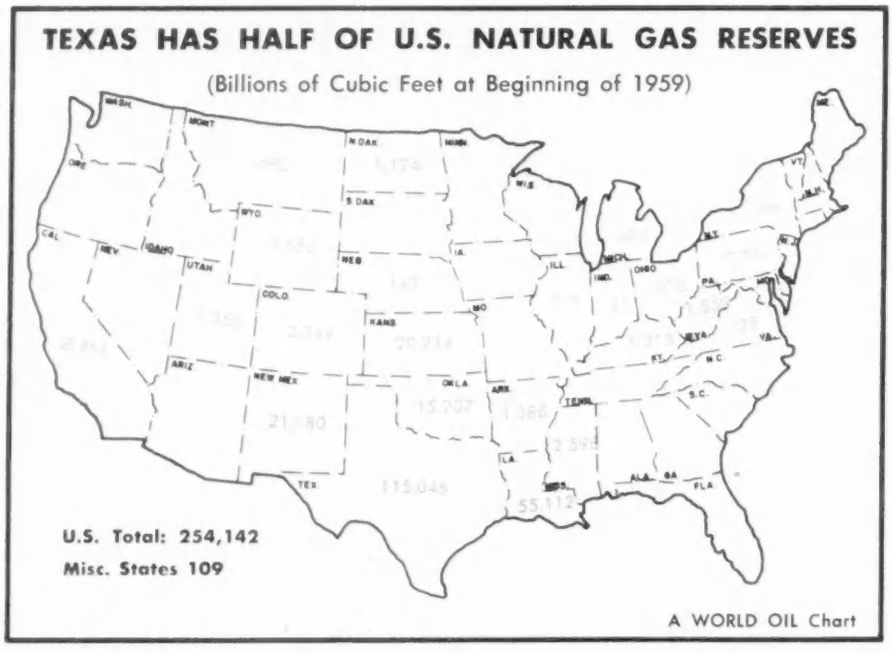
YEAR	Reserves End of Year (Billion Cubic Feet)	Authority for Estimate of Reserves	Net Production (Billion Cubic Feet)	Ratio Reserve to Annual Prod.
1918	15,000	E. Holley Poe[1]	721	20.8
1919	15,000	" "	746	20.1
1920	15,000	" "	798	18.8
1921	15,000	" "	662	22.7
1922	15,000	" "	763	19.7
1923	15,000	" "	1,007	14.9
1924	15,000	" "	1,142	13.1
1925	23,000	*Gas Facts*[2]	1,189	19.3
1926	23,000	" "	1,313	17.5
1927	23,000	" "	1,445	15.9
1928	23,000	" "	1,568	14.7
1929	23,000	" "	1,918	12.0
1930	46,000	Earl P. Hines[3]	1,943	23.7
1931	46,000	" "	1,686	27.3
1932	46,000	" "	1,556	29.6
1933	46,000	" "	1,555	29.6
1934	62,000	Ralph E. Davis[4]	1,771	35.0
1935	62,000	" "	2,408	25.7
1936	62,000	" "	2,571	24.1
1937	66,000	" "	2,854	23.1
1938	70,000	Lyon F. Terry[5]	2,960	23.6
1939	70,000	" "	3,162	22.1
1940	85,000	Ralph E. Davis[4]	3,331	25.5
1941	113,800	P.A.W.[6]	3,459	32.9
1942	110,000	"	3,701	29.7
1943	110,000	"	4,336	25.4
1944	133,500	"	4,731	28.2
1945	147,789	A.G.A.[7]	4,840	30.5
1946	160,576	"	4,943	32.5
1947	165,927	"	5,630	29.5
1948	173,869	"	6,008	28.9
1949	180,381	"	6,245	28.9
1950	185,593	"	6,893	26.9
1951	193,811	A.G.A.[7]	7,967	24.3
1952	199,716	"	8,640	23.1
1953	211,447	"	9,239	22.9
1954	211,711	"	9,427	22.5
1955	223,697	"	10,118	22.1
1956	237,775	A.G.A.[7]	10,908	21.7
1957	246,569	"	11,502	21.4
1958	254,142	"	11,485	22.1

[1] And Associates, New York, in report September 23, 1947. [2] American Gas Association yearbook, 1945 and 1946. [3] Then with Cities Service Co., New York. [4] Consulting Engineer, Houston. [5] Formerly of Chase National Bank, New York. [6] Petroleum Administration for War. [7] American Gas Association.

Louisiana's share of gas reserves increases

SINCE 1956, the six leading natural gas reserve states have maintained almost exactly the same share of the U.S. total—92.8 percent. However, there has been some shifting of percentages within those states.

For example, at the start of 1956 Texas reported 108.3 trillion cubic feet of gas reserves, for 48.4 percent of the nation's total. On the same date in 1959, the state's reserves had increased to 115 trillion cubic feet, but its share of all U.S. reserves had dropped to 45.3 percent.


TEXAS HAS HALF OF U.S. NATURAL GAS RESERVES
(Billions of Cubic Feet at Beginning of 1959)
U.S. Total: 254,142
Misc. States 109
A WORLD OIL Chart

Estimated Proved Reserves of Natural Gas in U.S., by States, at End of 1958 and 1957

(Source: AGA . . . Millions of Cubic Feet-14.65 psia, at 60 Deg. F.)

STATE	DECEMBER 31, 1958		DECEMBER 31, 1957	
	Million Cu. Ft.	Percent of U.S.	Million Cu. Ft.	Percent of U.S.
Arkansas	1,388,337	.54	1,283,022	.52
*California	8,966,522	3.53	8,952,893	3.63
Colorado	2,349,240	.93	2,380,679	.96
Illinois	170,528	.07	166,372	.07
Indiana	30,569	.01	30,952	.01
Kansas	20,233,847	7.96	19,295,978	7.83
Kentucky	1,215,329	.48	1,225,045	.50
*Louisiana	55,111,862	21.69	51,435,954	20.86
Michigan	498,113	.19	444,028	.18
Mississippi	2,598,377	1.03	2,297,740	.93
Montana	682,013	.27	670,450	.27
Nebraska	143,321	.05	189,339	.08
New Mexico	21,180,020	8.34	22,258,009	9.02
New York	96,439	.03	93,382	.04
North Dakota	1,124,470	.45	743,432	.30
Ohio	818,052	.32	901,814	.37
Oklahoma	15,206,769	5.98	14,259,480	5.78
Pennsylvania	870,014	.34	853,595	.35
*Texas	115,045,743	45.27	113,084,518	45.86
Utah	1,058,051	.42	859,294	.35
Virginia	38,421	.01	37,521	.01
West Virginia	1,557,633	.61	1,560,930	.64
Wyoming	3,649,818	1.43	3,457,433	1.40
†Miscellaneous	108,549	.05	87,395	.04
Total, U.S.	254,142,037	100.00	246,569,255	100.00

* Includes off-shore reserves.
† Includes Ala., Ariz., Fla., Md., Mo., Va.

Louisiana's share increases. Louisiana made up for Texas' percentage deficit during the three-year period, increasing its gas reserves 12.7 trillion cubic feet, from 42.4 to 55.1 trillion cubic feet. The state's share of the U.S. total increased from 18.97 percent to 21.69 percent.

During the January 1, 1958-January 1, 1959 period alone, Louisiana's natural gas reserves increased 3.7 trillion cubic feet, while Texas' reserves increased about 2 trillion cubic feet.

Although it still accounts for only a small share of all U.S. reserves, North Dakota also made significant increases in gas reserves during the three-year period.

At the start of 1956, North Dakota reported 280.7 billion cubic feet of reserves. By January 1, 1959, the total has quadrupled to 1.1 trillion cubic feet, with 381 billion cubic feet of the increase being added during 1958.

Other leading states. The four remaining major natural gas reserve states reported the following changes during 1958:

New Mexico's total decreased 1.1 trillion cubic feet to 21.2 trillion cubic feet, for 8.3 percent of all U.S. gas reserves. Kansas increased its reserve total 938 billion cubic feet to 20.2 billion cubic feet, 7.96 percent of the U.S. total.

Oklahoma's reserves increased 948 billion cubic feet to 15.2 trillion, 5.98 percent. California's total increased 14 billion cubic feet to 8.97 trillion, 3.53 percent.

Other states. The seventh and eighth ranking states both increased their gas reserve totals during 1958. Wyoming reported 3.6 trillion cubic feet on January 1, 1959, up 191.4 billion cubic feet from the same date in 1958. Mississippi increased its reserve total 300.6 billion cubic feet to 2.6 trillion cubic feet.

Ohio had the largest decrease in natural gas reserves during 1958, reporting 818 billion cubic feet on January 1, 1959, down 83.8 billion cubic feet. Colorado's reserve total decreased 31.4 billion cubic feet to 2.3 trillion cubic feet, and Nebraska's total dropped 46 billion cubic feet to 143.3 billion.

Gas reserves-drilling ratio improves

AFTER DROPPING slightly in 1957, the amount of natural gas reserves found in relation to drilling effort increased during 1958. Following is the picture in brief:

- New gas reserves found per well drilled averaged 401 million cubic feet, up 17 million cubic feet or 4.4 percent from 1957.
- New reserves found per productive well drilled averaged 653 million cubic feet, up 27 million cubic feet or 4.3 percent.
- New reserves per foot drilled averaged 99,000 cubic feet, up 7,000 cubic feet or 7.6 percent.

Although the reserves to drilling ratio increased during 1958, the averages still were far below the beginning of the post war era. The reserves found per well drilled in 1946 averaged 229 million cubic feet or 57 percent greater.

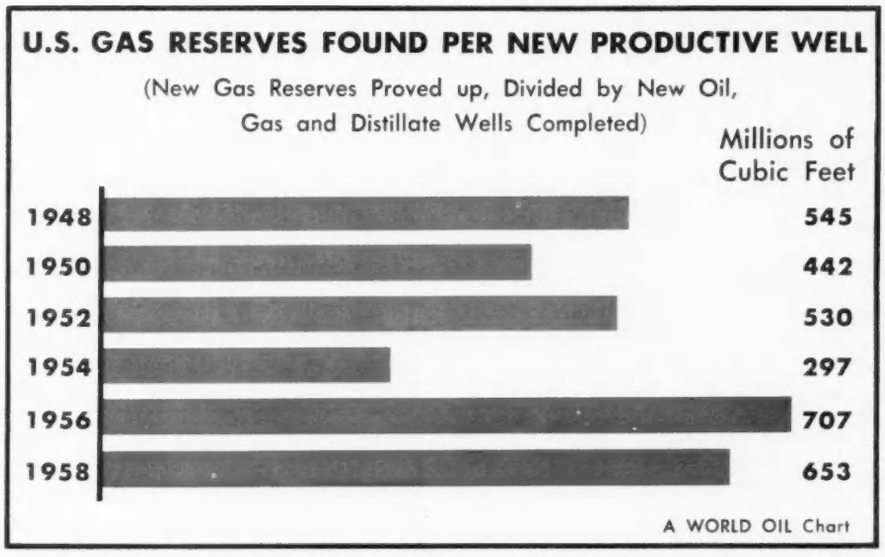
New reserves found per well drilled averaged 249 million cubic feet or 38.1 percent greater in 1946; and the 181,000 cubic feet of new reserves found per foot drilled averaged nearly twice the 1958 average of 99,000 cubic feet.

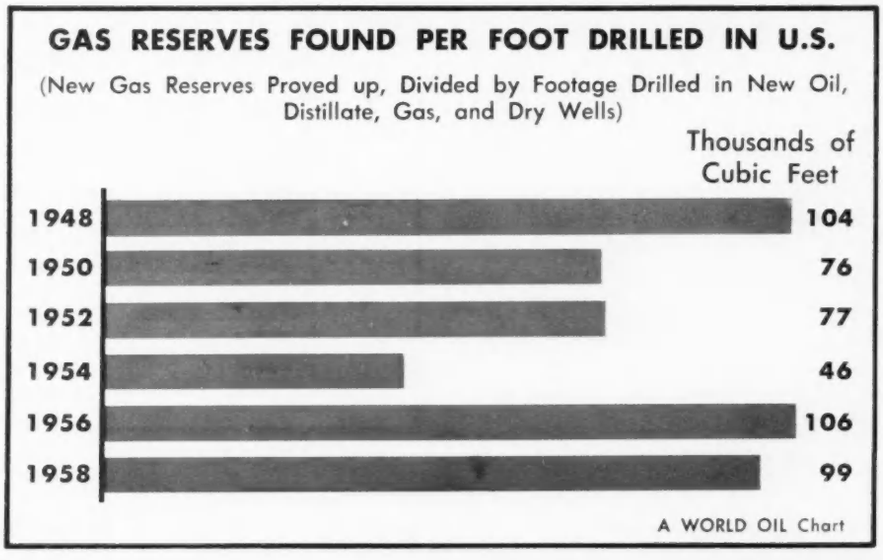
Experience during the post war years indicates the industry's ability to maintain a respectable reserves found to drilling ratio, despite sharp fluctuations from year to year. With but one exception (1949 and 1950) the ratio has improved rapidly following a year of decrease.

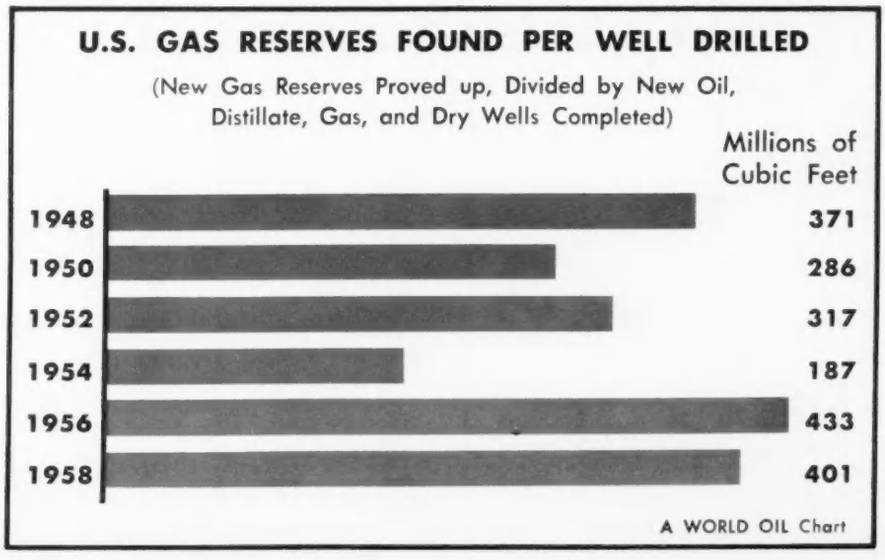
Natural Gas Reserves Developed Annually in U.S. in Relationship to Drilling Effort

YEAR	Millions of Cu. Ft. Per Well Drilled	Thousands of Cu. Ft. Per Foot Drilled	Millions of Cu. Ft. Per Productive Well
1946	630	181	902
1947	353	100	515
1948	371	104	545
1949	335	93	509
1950	286	76	442
1951	360	92	593
1952	317	77	530
1953	424	104	694
1954	187	46	297
1955	399	97	636
1956	433	106	707
1957	384	92	626
1958	401	99	653

Wells drilled include all wells drilled in search of production and completed as oil, gas, distillate and dry holes. Productive wells includes all wells completed in year as oil, gas or distillate producers.


U.S. GAS RESERVES FOUND PER NEW PRODUCTIVE WELL
(New Gas Reserves Proved up, Divided by New Oil, Gas and Distillate Wells Completed)
Millions of Cubic Feet
1948 545
1950 442
1952 530
1954 297
1956 707
1958 653
A WORLD OIL Chart


GAS RESERVES FOUND PER FOOT DRILLED IN U.S.
(New Gas Reserves Proved up, Divided by Footage Drilled in New Oil, Distillate, Gas, and Dry Wells)
Thousands of Cubic Feet
1948 104
1950 76
1952 77
1954 46
1956 106
1958 99
A WORLD OIL Chart


U.S. GAS RESERVES FOUND PER WELL DRILLED
(New Gas Reserves Proved up, Divided by New Oil, Distillate, Gas, and Dry Wells Completed)
Millions of Cubic Feet
1948 371
1950 286
1952 317
1954 187
1956 433
1958 401
A WORLD OIL Chart

Free world drilling to expand 4.6 percent

FREE WORLD drilling rates are expected to increase 4.6 percent in 1960 outside the United States and Canada. A total of 5,017 completions in those areas is forecast for this year, compared with 4,795 tabulated (and partially estimated) for last year.

Drilling in Mexico has been noticeably stepped up. Petroleos Mexicanos (Pemex) completed 439 wells in 1959, compared with 379 in 1958. Pemex has an ambitious drilling program scheduled for 1960, with more than 600 wells programmed. WORLD OIL estimates that 525 of these wells will be completed this year.

In South America, completions in Venezuela continue to drop abrubtly from 1,191 in 1958 to 700 in 1959. It is expected that they will decrease further to 500 in 1960. On the other hand, activity pursuant to recent drilling contracts is proceeding well in Argentina; 700 completions are predicted in 1960.

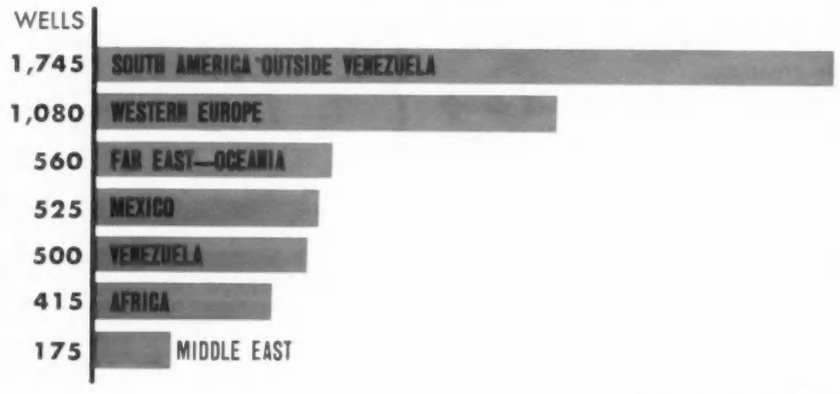
The Middle East is expected to remain about status quo, with 175 completions expected this year. Some increased activity is expected in Syria, where West German interests have discovered a new oil field in the extreme northeastern part of the country.

Drilling activity is expected to remain about the same in Western Europe. Some decline in wildcatting is expected in France, but it will probably be offset, statistically speaking, by an increase in development well completions.

In Africa, completions are expected to increase to a peak of 415 wells. As many as 80 wells may be completed in Libya. Oasis Oil Company has 10 rigs operating inland from the Gulf of Sirte, drilling stepout tests to moderate depths.

A slightly increased number of completions is forecast for the Far East this year. Unusually heavy activity is expected in Australia, where an encouraging gas find has been made recently at shallow depths. In the Philippines, shallow oil production has been found, and several recent tests have had good shows. Drilling is expected to remain steady in both Indonesia and Japan in 1960.

SOUTH AMERICA AND EUROPE TO BE TOP AREAS IN 1960 DRILLING OUTSIDE U.S. AND CANADA



A WORLD OIL Chart

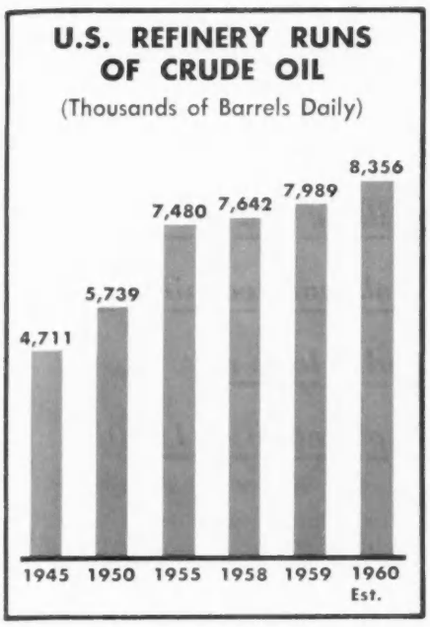
1960 Drilling Prospects for Free World

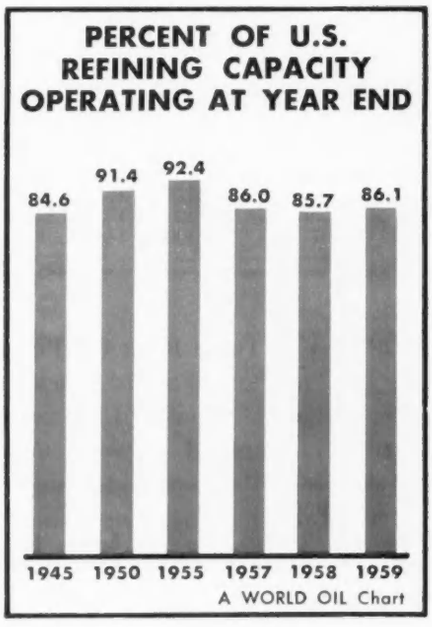
(Exclusive of U.S., Canada, and U.S.S.R. and Soviet Satellite Countries)

REGION	Wells Forecast 1960	WELLS DRILLED 1959	WELLS DRILLED 1958
North America, Outside U.S. and Canada	**530**	**467**	**442**
Mexico	525	439	379
Cuba-Jamaica-Haiti-Bahamas	5	28	63
Central America	**12**	**8**	**12**
South America	**2,245**	**2,158**	**2,481**
Argentina	700	560	390
Brazil	280	186	140
Chile	80	90	74
Colombia	180	180	174
Trinidad	320	300	295
Venezuela	500	700	1,191
Other South America	185	142	217
Middle East	**175**	**178**	**192**

REGION	Wells Forecast 1960	WELLS DRILLED 1959*	WELLS DRILLED 1958
Western Europe	**1,080**	**1,090**	**1,074**
West Germany	500	530	534
Austria	70	80	93
France	225	220	184
Italy-Sicily	200	180	163
Other Western Europe	85	80	100
Africa	**415**	**345**	**345**
Algeria	140	130	110
Other Africa	275	215	235
Far East-Oceania	**560**	**549**	**524**
Japan	250	225	269
Indonesia	160	165	172
Other Far East	150	159	83
Total	**5,017**	**4,795**	**5,070**

* Not including suspended.
* 1959 completions partially estimated in some areas.





U.S. Crude Runs to Stills, by Years

Source: Bureau of Mines, except Nov.-Dec. 1957 from API.

(THOUSANDS OF BARRELS)

Year	Total	Daily	Year	Total	Daily
1918...	326,025	893	1939	1,237,840	3,391
1919...	361,520	990	1940	1,294,283	3,536
1920...	433,915	1,186			
			1941	1,409,192	3,861
1921...	443,363	1,215	1942	1,334,103	4,655
1922...	500,706	1,372	1943	1,429,738	3,917
1923...	581,238	1,592	1944	1,665,684	4,551
1924...	643,719	1,759	1945	1,719,534	4,711
1925...	739,920	2,027			
			1946	1,730,197	4,740
1926...	779,264	2,135	1947	1,852,246	5,075
1927...	828,835	2,271	1948	2,048,349	5,597
1928...	913,295	2,295	1949	5,944,221	5,327
1929...	987,708	2,706	1950	2,094,867	5,739
1930...	927,447	2,541			
			1951	2,370,404	6,494
1931...	894,608	2,451	1952	2,441,259	6,670
1932...	819,997	2,240	1953	2,554,865	7,000
1933...	861,254	2,360	1954	2,539,564	6,958
1934...	895,636	2,454	1955	2,730,218	7,480
1935...	965,790	2,646			
			1956	2,905,106	7,937
1936- .	1,068,570	2,919	1957	2,890,436	7,919
1937 .	1,183,440	3,242	1958	2,789,404	7,642
1938...	1,165 015	3,192	1959	2,915,929	7,989
			1960 Est.	3,058,296	8,356

Runs to stills will increase 4.6 percent

CRUDE RUNS to still at U.S. refineries will need to average 8,356,000 barrels daily in 1960, if expected demand for products is met and stocks of products are increased an estimated 8.4 million barrels or 23,000 daily. These estimates were made by the Bureau of Mines.

The projected refinery runs would be 367,000 barrels per day or 4.6 percent above those of 1959. The runs of 7,989,000 daily in 1959 were 347,000 barrels or 4.5 percent above those of 7,642,000 daily in 1958.

Refinery runs were higher than desirable in the first half of 1959, but they were more reasonable in the latter half, and stocks of products consequently showed only a slight net increase for the year.

Higher crude runs in 1960 than those forecast above would result in a greater build-up in product stocks than the 8.4 million barrels allowed for and an over-supply situation would be promoted.

U. S. refinery runs at the start of 1960 averaged about 8.4 million barrels daily, or 86.1 percent of capacity. At the beginning of 1959 they averaged about 8.3 million barrels per day, or 85.7 percent of capacity.

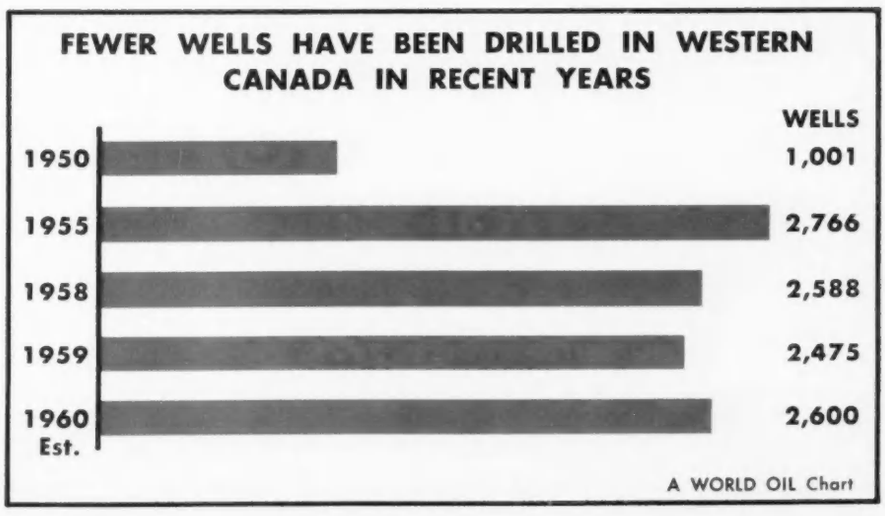
Canadian drilling expected to rise in 1960

CANADA'S ABILITY to produce much more oil than markets can absorb will continue to retard drilling. WORLD OIL forecasts the drilling of 3,025 wells and 13.6 million feet of hole in Canada in 1960, only a modest increase over 1959.

The 2,875 wells and 13 million feet of hole drilled in 1959 were slightly less than the 2,960 wells and 13.5 million feet drilled in 1958.

Western Canada is expected to account for 2,600 completions and footage of 13 million feet in 1960, compared with 2,475 wells and 12.4 million feet in 1959.

WORLD OIL forecasts for Eastern Canada 425 completions and 630,000



Forecast of Wells and Footage to Be Drilled in Canada During 1960

	Western Canada		Eastern Canada		All Canada	
	Wells	Footage	Wells	Footage	Wells	Footage
1960 Forecast	**2,600**	**13,000,000**	**425**	**630,000**	**3,025**	**13,630,000**
1959	2,475	12,364,130	400	600,000	2,875	12,964,130
1958	2,588	12,949,373	372	558,000	2,960	13,507,373
1957	2,993	13,968,509	446	577,139	3,409	14,545,648

feet of hole in 1960, compared with 400 wells and 600,000 feet in 1959, and 372 wells and 558,000 feet in 1958.

In prospect is a possible record level of exploratory drilling in Western Canada, especially the Northwest Territories and northeast British Columbia. Exploratory drilling on Canada Southern Petroleum Ltd.'s properties, Northwest Territories, will be significant, representing initial testing of the largest structure mapped by seismic methods in the sedimentary basin of Western Canada, east of the Rockies.

Early construction of an oil pipe line into the Fort St. John-Boundary Lake area by Peace River Oil Pipeline Ltd., may cause record development drilling in Boundary Lake field, where 15 completed oil wells may have proved or semi-proved 60 additional locations.

The newly-formed Canadian Energy Board plans to review applications for daily exportation of an additional 857 Mmcf of Canadian natural gas to U. S. markets.

Westcoast Transmission Line has begun paying natural gas producers in northeast British Columbia 9¼ cents per thousand cubic feet of gas plus an allowance of about ¾ cent per thousand feet for liquids contained in the gas.

On the following pages are a roundup of new drilling and producing tools and techniques . . . and a look at exploration in 1960

What's New In Drilling

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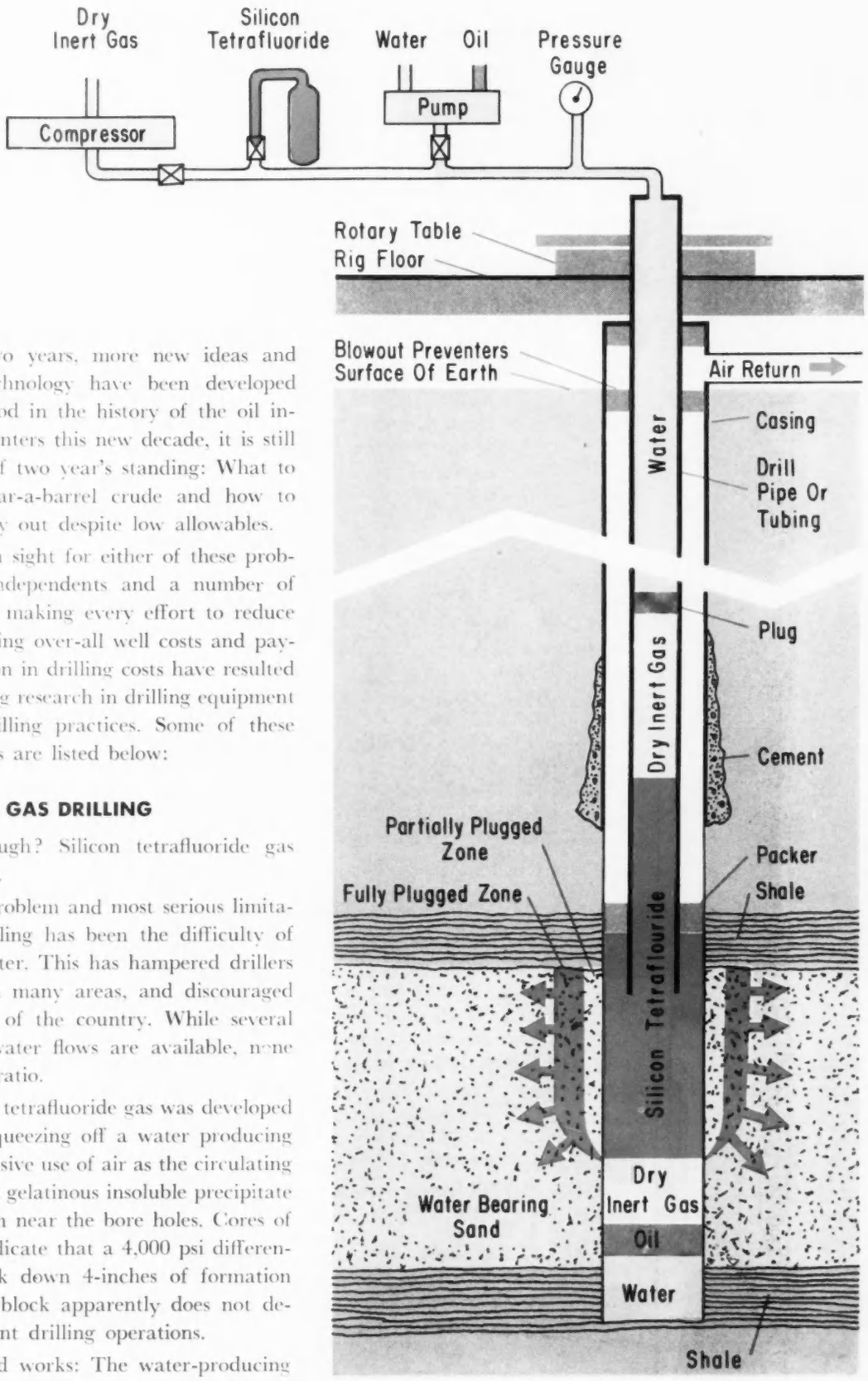


FIGURE 1—Schematic diagram of the method used to shut off water encroachment while using silicon tetrafluoride gas during air or gas drilling operations.

DURING THE PAST two years, more new ideas and advances in drilling technology have been developed than in any similar period in the history of the oil industry. As the industry enters this new decade, it is still plagued with problems of two year's standing: What to do about imported dollar-a-barrel crude and how to make expensive wells pay out despite low allowables.

There is no solution in sight for either of these problems. However, many independents and a number of major oil companies are making every effort to reduce drilling costs, thus reducing over-all well costs and payout periods. The reduction in drilling costs have resulted from extensive engineering research in drilling equipment and improvement in drilling practices. Some of these new ideas and techniques are listed below:

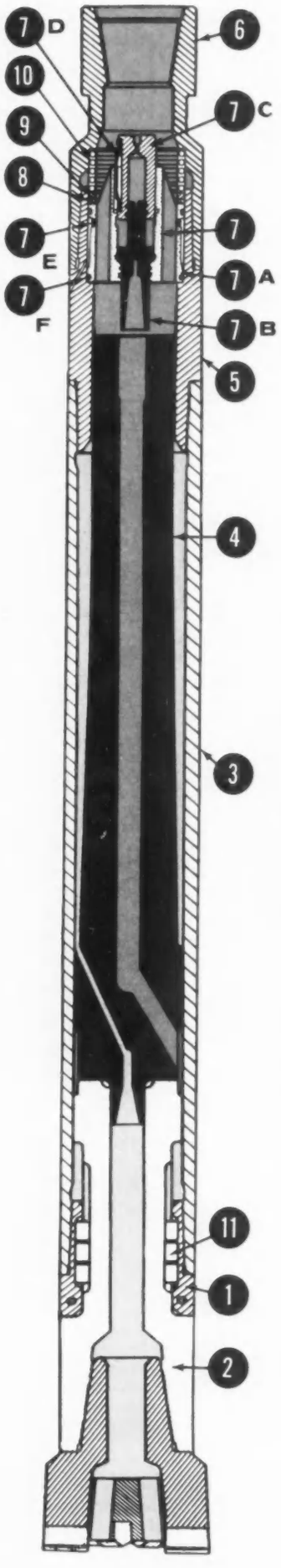
AIR AND GAS DRILLING

► The big breakthrough? Silicon tetrafluoride gas stops sizable water flows.

Until now, the chief problem and most serious limitation on air and gas drilling has been the difficulty of controlling formation water. This has hampered drillers who used the method in many areas, and discouraged its use in other sections of the country. While several methods of controlling water flows are available, none has had a high success ratio.

Recently, a new silicon tetrafluoride gas was developed which may be used in squeezing off a water producing zone, enabling more extensive use of air as the circulating medium. This gas forms a gelatinous insoluble precipitate which clogs the formation near the bore holes. Cores of these treated intervals indicate that a 4,000 psi differential is necessary to break down 4-inches of formation invasion. Moreover, this block apparently does not deteriorate during subsequent drilling operations.

Here's how the method works: The water-producing formation is completely penetrated, and a packer is spotted above the formation in the drill string (Figure 1). Diesel oil usually is used to displace the water from the formation interval and the packer is set. Next, the silicon tetrafluoride is weighed and bled from cylinders



into the drill pipe. It is chased with natural gas or compressed air, and a squeeze pressure ranging from 500 to 650 psi per 1,000 feet of depth is applied to the formation. (Care should be taken not to fracture the formation.)

After a delay of about 30 minutes, the packer is unseated and the drill pipe is tripped from the hole and drilling operations are resumed. Thus far, 500 foot intervals have been successfully treated. It is likely that even thicker zones could be shut off.

A new type open hole packer has been developed which may be run in the drill string while drilling and can be expanded when such a squeeze operation is desired. This new development will enhance the use of this gas and decrease the cost of the round trips that are necessary when using this water shut-off technique.

► Foaming agents are successful in shutting off intermediate water flows. Where intermediate water flows in the range of 3 to 50 barrels per hour are encountered, foaming agents are proving successful. At least 20 different types of foamers are now being used. The proper choice in any instance will depend on whether the formation water is fresh, salty or contains sulfur compounds.

The foam is mixed with water, injected into the discharge from the compressors and circulated throughout the system. Most of the foamers are designed to minimize the wetting damage to shales, thus reducing the chances of sloughing.

Once this latter practice is initiated, air pressure generally will rise, resulting in an increase of 10 to 20 percent compressor horsepower.

NEW PERCUSSION DRILL

A new percussion drill increases penetration rates 3 to 5 times. This new bottom-hole tool, which has been under development for several years, is located just above the bit (Figure 2). In the most popular size unit for oil well drilling, the principal moving part is a hammer which strikes in a trip-hammer fashion. The drill pipe is rotated at slow speed with relatively low bit weights.

This method of drilling excels conventional air drilling in hard formations. In soft formations, the penetration rate is about the same. The unit is designed to work with foam where small water flows impede drilling.

CONTINUOUS CORES

During the latter part of 1959, a new drilling technique (See WORLD OIL, January 1960, Page 111) was developed which recovers virtually 100 percent of the cores as it drills. This method uses a 4-inch dual string of drill pipe and a 2½-inch "core tube" which are welded and rotated together as an integral unit.

Light drilling mud is circulated down annulus of dual string,

KEY TO DIAGRAM

1. Driver sub
2. Anvil
3. Hammer case
4. Hammer
5. Top piston case
6. Sub
7A. Valve body
7B. Top finger valve
7C. Top finger valve guide
7D. Lock spring seal
7E. O-Ring
7F. O-Ring
8. ⅛-inch spacer
9. ¼-inch spacer
10. Hold-down spring
11. Drive pins

EXHAUST AIR

LINE PRESSURE

FIGURE 2

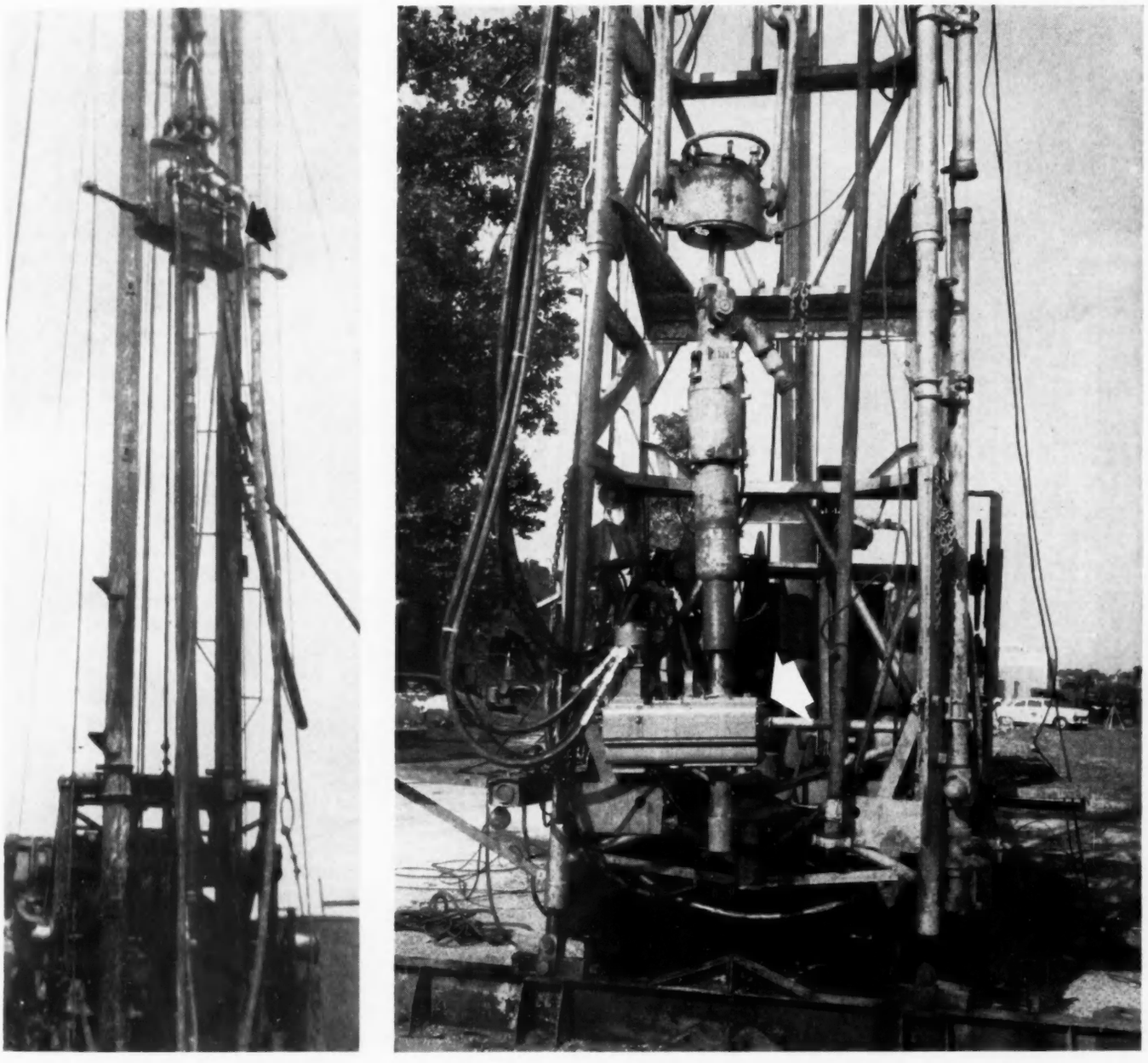


FIGURE 3—The rotary table has been replaced by a power hydraulic swivel (left) and a hydraulic sub (right).

out into the hole through ports just above the bit, through the bit, and to the surface through the 2½-inch core tube. The hole annulus mud must have lubricating properties, must prevent hydration of shales, must form a thin tough fiber cake, and must be somewhat heavier than the circulating mud.

The core is broken off in 6-inch increments by a core breaker and is transmitted to the surface through the core tube along with cuttings. On a recent test in West Texas, this technique resulted in a core recovery of virtually 100 percent of the drilled footage.

This rig features a power swivel which makes it unnecessary to lift the bit off the core to add a joint of drill pipe, and the small mud system requires a minimum amount of hydraulic surface requirements.

Advantages of this new technique are many—an important one is that it may enable operators to find production which otherwise might be missed.

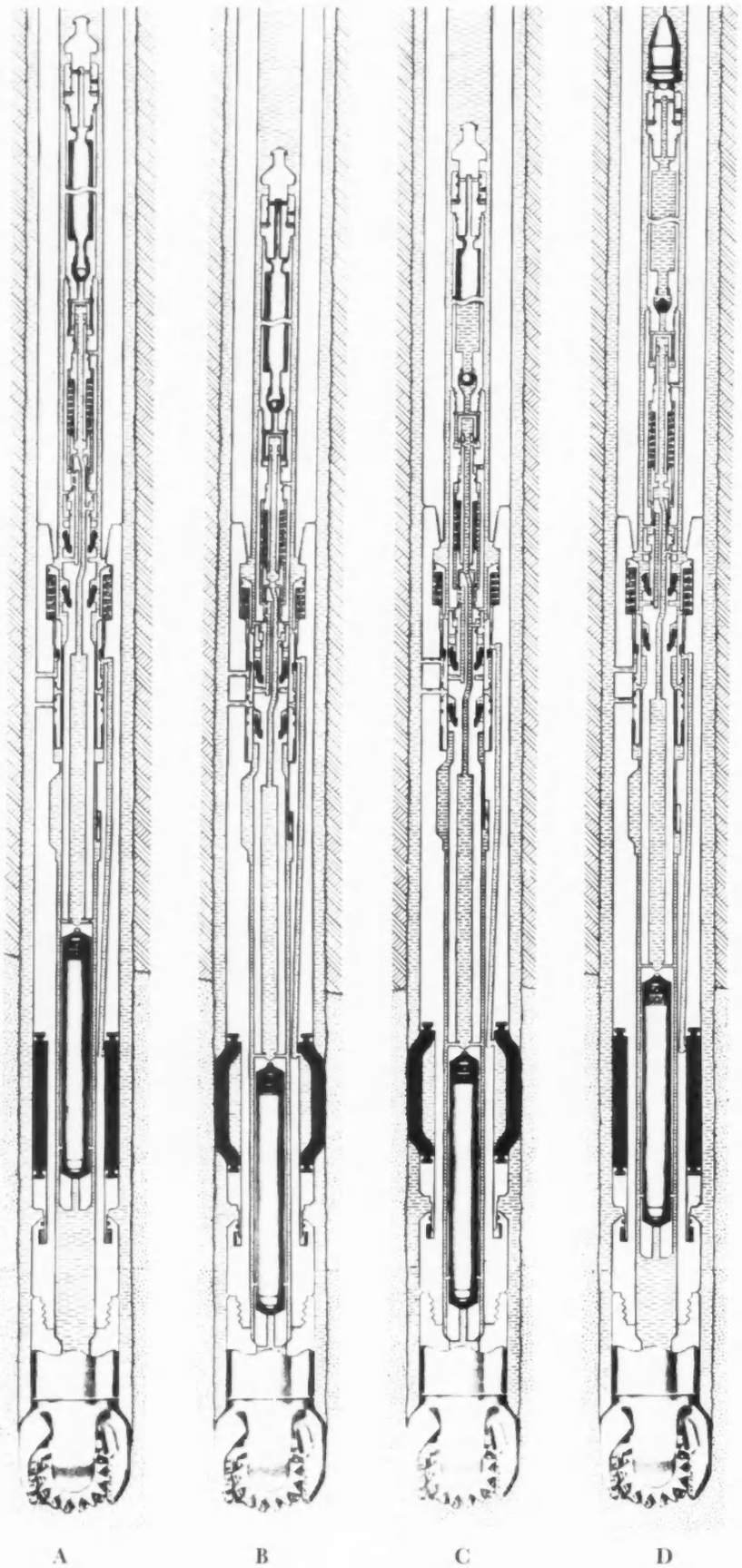
NEW DRIVES FOR DRILLING

► Power swivels and subs are growing more popular. Many drilling contractors have wondered whether the kelly, rotary, rotary and kelly drive bushings, etc., and rat hole could be eliminated, and whether a simple power swivel or power sub to drive the pipe could be substituted.

Because of the many advances made recently in hydraulic drives, a number of such subs and swivels (Figure 3) now are available and are being used successfully. Earlier models were limited by torque specifications; however, this difficulty has been alleviated and high torque low speed requirements are being overcome.

In each instance, the swivel must be restrained from rotating—usually by guide cables running vertically at either side of the swivel.

► Other drives for drilling rigs. AC powered drilling rigs are grow-



A. Dropping Sampler
B. Inflating Packer
C. Sampling Formation
D. Retrieving Sampler

FIGURE 4—Schematic operational diagram for the continuous retrievable sampler.

ing more popular. Workover rigs are using trailer-mounted diesel generator sets which provide electricity for the pump, drawworks, etc. Several offshore operating rigs also are using AC motors throughout for power.

Several units which are using hydraulic drives are showing excellent over-all efficiency—despite the somewhat low performances normally inherent in hydraulic systems.

FORMATION TESTING

► A new formation fluid sampler allows formation evaluations to be made while drilling without round trips. A packer is incorporated as part of the drilling string, and the formation fluids are recovered in a retrievable sample reservoir.

The sample container usually recovers samples of 25 gallons or more. Usually, rat hole mud, if it should enter the sampler, is confined to the top of the sample chamber where it is held by a series of check valves. Almost pure formation fluids are contained in the bottom section of the sample chamber. A pressure recorder in the sampler records all pressures.

The tool itself consists of two major assemblies—packer assembly and sampler assembly.

Method of obtaining a formation sample. The sampler assembly is run into the well (Figure 4) and seated in the packer assembly. The packer is inflated against the walls of the bore hole due to a pressure differential created across the sleeve. With the packer set, additional pressure across the differential area of the sampler valve causes it to overcome the spring force holding it closed, allowing the valve to open. Formation fluids then may flow into the bit, passageways, sampler valve, and into the barrels.

The sampler assembly is returned with a sand line (Figure 4) and the sampler barrel pressure is bled off at the surface by a bleed-off valve below the fishing neck.

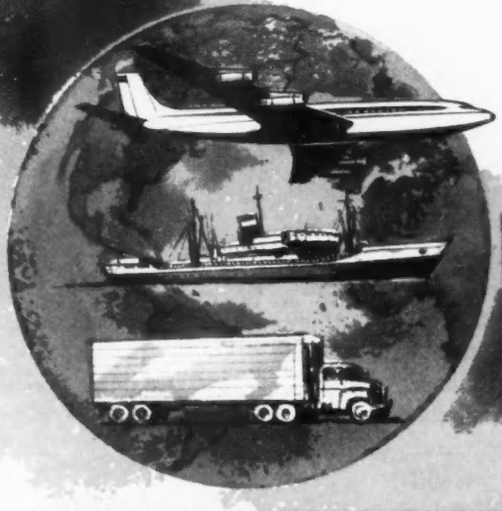
► A rubber sleeve that stretches over a core as it is cut, protecting it from long exposure to mud, is bringing better information to the surface. The rubber sleeve protects the fractured and unconsolidated sections of formations which tend to swell or decompose in water-base mud. Also, the compacting force acts to hold the core intact as it is cut.

Continued on next page

ADVANCED ENGINEERING

CONSTANT RESEARCH

MODERN MACHINING



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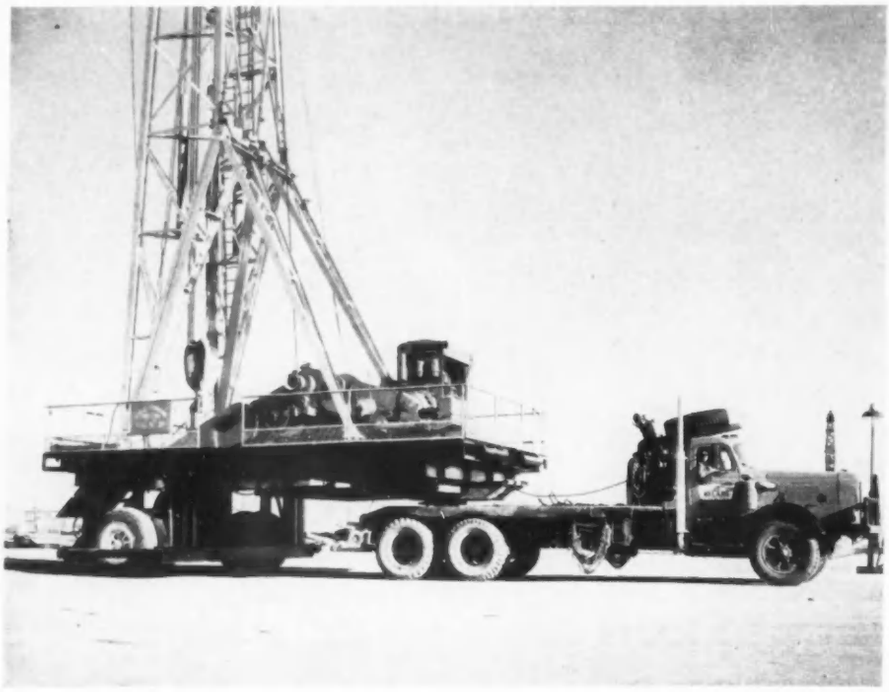

FIGURE 5—This highly portable rig is being used in Alberta. The heavy-duty truck is backed under the rig, latches the fifth wheel and drives off with mast still erect.

PORTABILITY FOR DRILLING RIGS

A highly portable rig has been developed for use in the Libyan desert in North Africa. Mounted on semi-trailers with oversized tires, the rig can move 20 to 30 miles in the desert and be ready to spud in in eight hours. The rig is designed to handle 10,000-plus feet of 4½-inch drill pipe. The equipment moves in eight loads.

One of the quickest rigs to move is being used on development drilling in Canada (See Figure 5). It can be moved from one site, over rolling or level terrain, and spotted on another location in a minimum of time. The company—using the rig in eastern Alberta—simply backs a heavy duty tractor-truck under the rig, latches the fifth wheel and drives off with the mast remaining erect. Four large tires support the main part of the rig along with the tandem truck shown in Figure 5. The rig is adequately equipped and designed to drill to a depth of 5,000 feet.

NEW ORIENTING SUB

A new orienting sub has sharply reduced the time normally required for orienting whipstocks (Figure 6). A whipstock can now be set below 12,000 feet in less than 30 minutes.

A gravity latch makes it possible to line up with the deviated hole; when the tool is turned in the hole, a ball in an oil-filled race seeks the lowest point. When the ball reaches the proper point, it will allow one foot of travel along a spline. This provides a positive mechanical indication at the surface that the sub is oriented with respect to the hole deviation.

Here is how the orienting sub is run:

Following directional survey, the sub is run above the deflection single just above the whipstock. It is carefully oriented with respect to the whipstock, and the tools are run to a point near the bottom where the pump is started. With low circulation, the driller lightly tags bottom. He marks the kelly for depth, and rotates the pipe 15 degrees to the right and again tags bottom. When the gravity latch is properly orientated with respect to the deviated hole, the spline will allow the kelly to indicate bottom a foot deeper than at other positions. This indicates that the tool is properly oriented, and after the pin is sheared, the whipstock is drilled off in the normal manner.

—The End

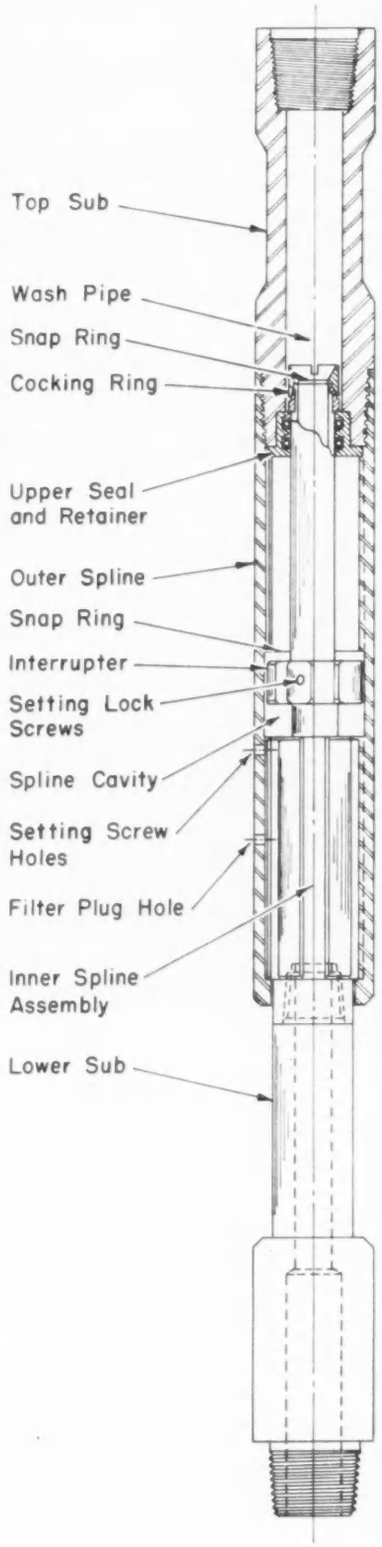

FIGURE 6—Bottom-hole orienting sub is composed of four sub assemblies. All are shown assembled in the extended position.

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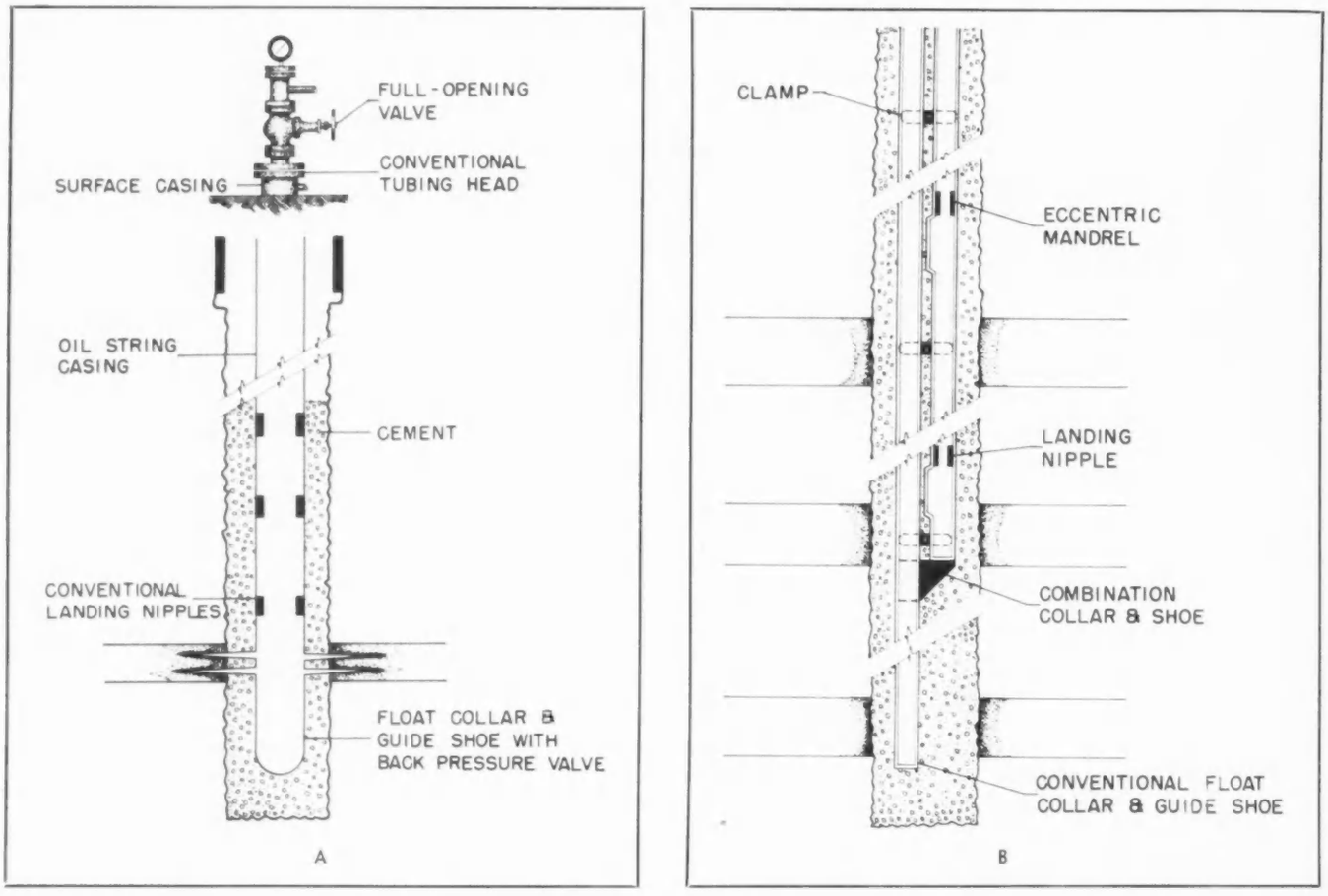


FIGURE 1—These schematic drawings show major items of equipment used in tubingless completions. A single completion is shown at left; right is a dual hookup.

Advancements in production methods—1959

By Richard J. Goeken
Area Petroleum Engineer
Gulf Oil Corp., New Orleans

IN REVIEWING the past year's practical developments and technological advancements, attention is immediately focused to the main spark of progress in production—the unending search for reduced operating costs and increased operating efficiency. Intensified competition in the petroleum industry and reduced profits have, of necessity, caused oil men to not only effect changes in organization and administrative procedures, but also to look for new developments in the field of production.

Some of the challenging problems now faced by industry may be solved by:

- Introduction of methods which will increase production without an attendant labor increase.
- Perfection of techniques which will increase ultimate recovery.
- Development of tools to reduce operating costs and increase efficiency.

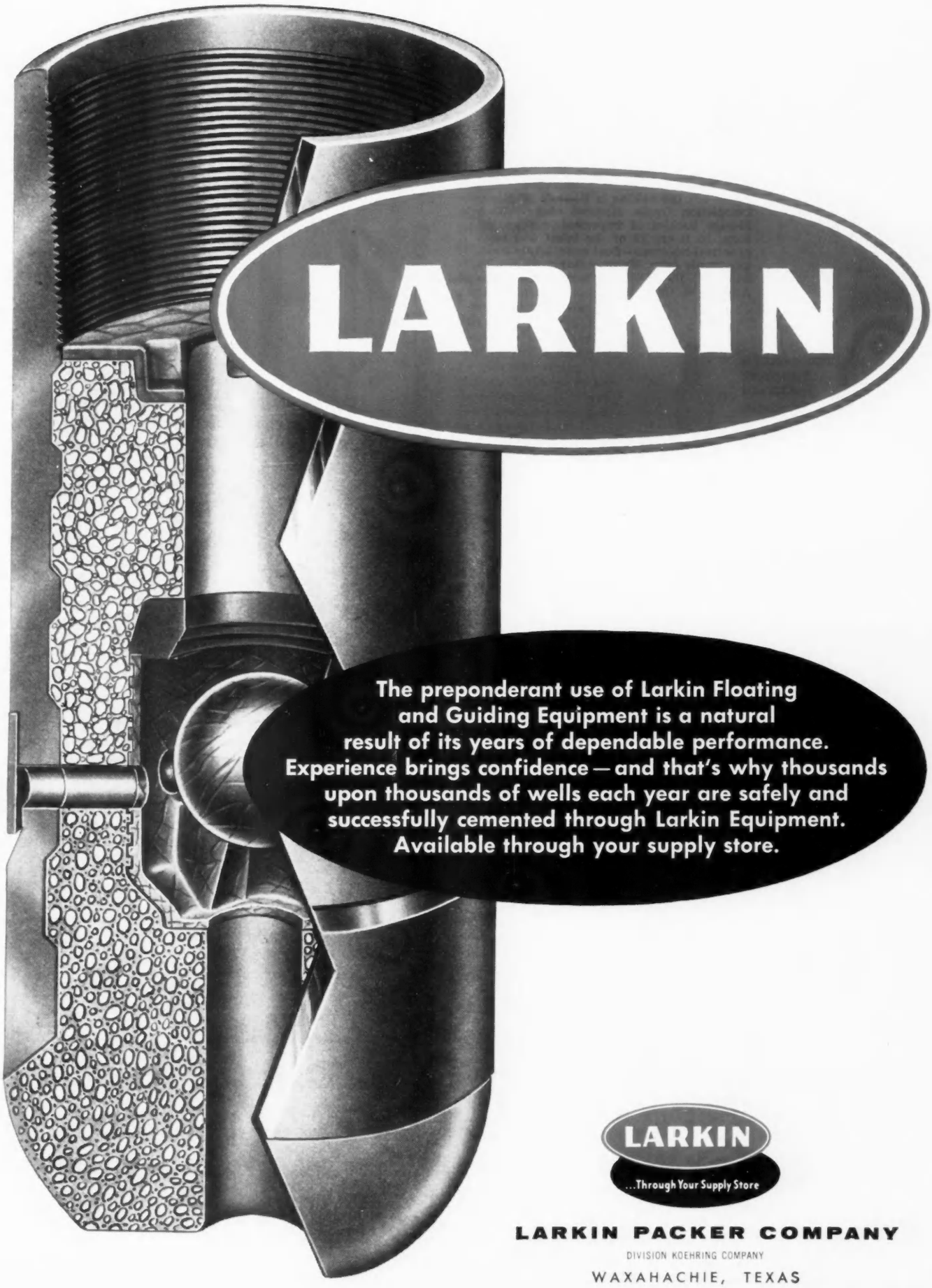
This challenge is being met by the oil operators, service organizations and research laboratories.

This article will review those developments which reached a degree of perfection during the past year as well as those which may be considered as being entirely new.

WELL COMPLETIONS

Tubingless completions. Developments in completion technology and workover techniques have made possible the use of conventional tubing as casing in oil well completions. Although not entirely new, this method of well completion has advanced rapidly in the past year and offers significant economic advantages over conventional methods.

Essentially, tubingless completions involve the miniaturization of oil and gas wells. The single tubingless completion is illustrated in Figure 1A. Pipe



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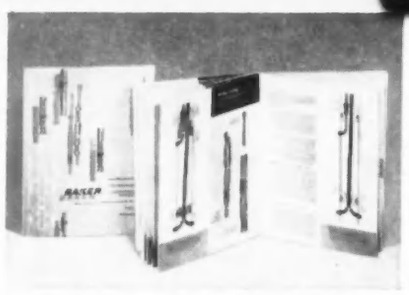

THE FACTS ABOUT MULTIPLE COMPLETION

Yours for the asking is Baker's Multiple Completion Guide, pictured above. It's a 24-page booklet of important engineering facts. In it are 13 of the latest and most practical hookups—dual zone, triple zone, quadruple zone. Write to Baker Oil Tools, Inc,. P.O. Box 2274, Terminal Annex, Los Angeles 54, California.

*9 Modern Production Packers

Single-Zone? Multiple-Zone? Water-Flooding? Deep Wells? Shallow? High Temperatures? Formidable Pressures? ■ The nine packers pictured here handle an impressive array of tough and simple production jobs.

* If you count the pictures, you come to number 9. But that's certainly not the total of packers made by Baker. For instance, Models "J" & "K" Snap-Set Packers are also made in double-grip versions. Model "E" is also offered with integral one-shot unloader, or with unloader and hold-down. Moreover, thanks to Baker's continuing program of packer research and development, new packers that will supplement the packers pictured above are coming.

These are D

Packer Accessories? Baker offers a complete line that makes the packers more usable and adaptable. Dual and triple string flow tubes, for instance, and plugs and other accessories.

BAKER MODEL "D" RETAINER PRODUCTION PACKER

Product No. 415-D

The most widely used drillable packer in the world. Contains continuous sealing bore and flapper-type back-pressure valve.

BAKER MODEL "DA" RETAINER PRODUCTION PACKER

Product No. 415-DA

Direct variation of Model "D" with a larger I.D. sealing bore located in the upper end of the packer. Permits larger bore through packer accessories. Used as an upper packer in two-packer flowing or pumping, parallel string hookups.

e Drillable

BAKER MODEL "F" RETAINER PRODUCTION PACKER

Product No. 415-F

Related design to Model "D". Contains larger continuous bore than Model "D" Used where extra large bore is required in some parallel (triple) string, flowing or pumping hookups.

BAKER MODEL "FA" RETAINER PRODUCTION PACKER

Product No. 415-FA

Related to the Model "F" Packer in the same manner that the Model "DA" is to Model "D". Contains extra large upper sealing bore. Provides largest I.D. of any retainer-type packer. Used in multiple string hookups exclusively.

These are Retrievable

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Used as the upper retrievable packers in two or three-packer, parallel-string installations. Provides largest full-opening bores possible. For instance, 7" size has full opening for two 2⅜" tubing strings. Actuated by set-down weight only, and can be set and released as many times as required. Short string can be run and retrieved separately. Model "J" is long-string set; Model "K" is short-string set. Also available are Double-Grip versions that contain built-in, button-type, hydraulic hold-downs.

(left)
Model "J" Single-Grip Snap-Set Dual Packer
Product No. 756-J

(right)
Model "K" Single-Grip Snap-Set Dual Packer
Product No. 756-K

BAKER MODEL "M" SNAP-SET PACKERS

Product No. 635-M

Used as the upper retrievable packer in two-packer, full-opening, selective cross-over, tubing and annulus production hookups. Set with set-down weight. Released and recocked for repeat setting by picking up on tubing.

BAKER MODEL "A" RETRIEVABLE TENSION PACKER

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BAKER MODEL "E" RETRIEVABLE CASING PACKER

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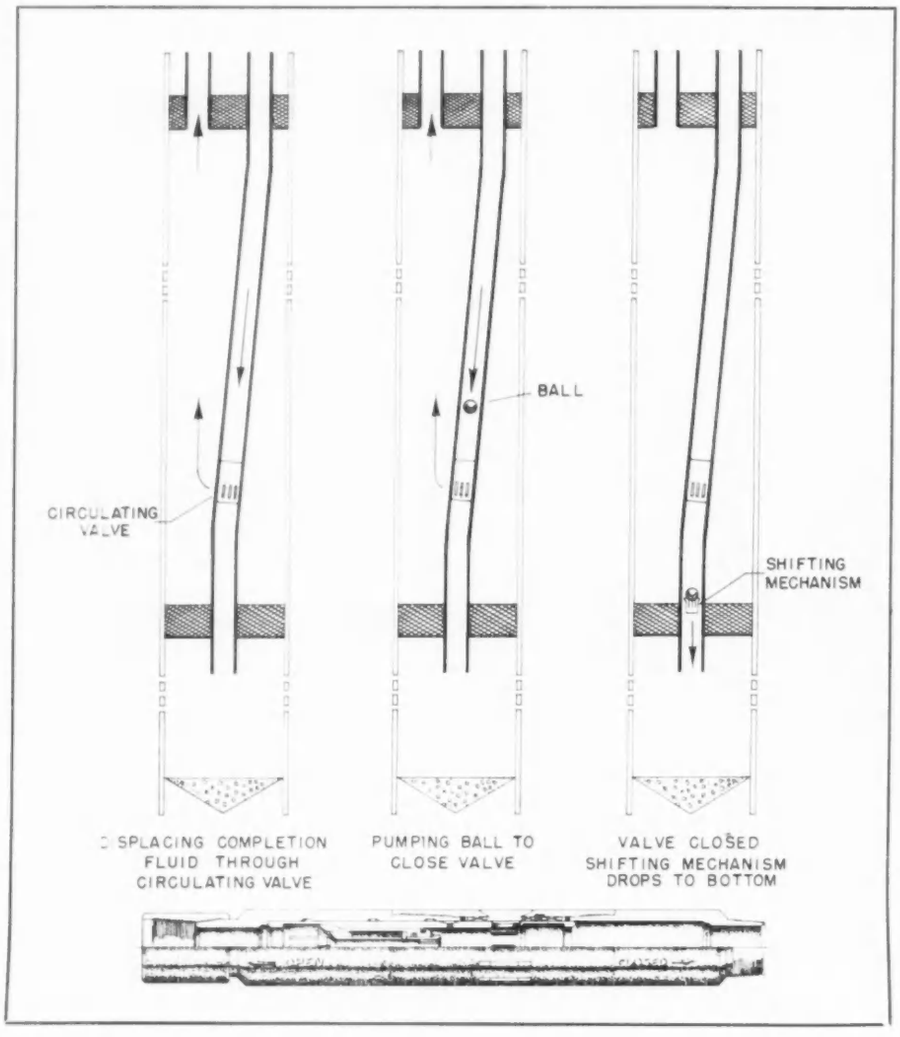


FIGURE 2—A new downhole circulating valve has proven useful in displacing multiple tubing string wells. All work is performed by the rig pump and expendable equipment. Wireline work is not required.

as small as 2⅞-inch OD has been used to case wells and in most instances no inner string of tubing is employed for production. Conventional casing-cementing equipment is used throughout the installation. The field proven methods of through-tubing workovers are utilized in completion and workover operations, and it has only been through these developments that small cased holes have been practical.

Multiple, as well as single tubingless completions have been effected as shown in Figure 1B. In this application, one load carrying string is run with the other strings being attached as parasites. Combination collar shoes and small centralizers are used on the parasite string. Cementing operations are performed through the longest string.

Perforating of multiple completions has led to development of a completely debris-free gun which provides positive directional control to prevent perforating the adjacent string. Directional perforating has been accomplished by the following methods:

1. Use of a mechanical orienting device operating in conjunction with an eccentric mandrel installed in the casing above the section to be perforated.

2. Employing a radioactive source and a mechanical rotating device on the perforating gun while radiation sensing devices are suspended in the adjacent strings.

3. Use of a nuclear orientor and rotator on the perforating gun enabling the operator to scan the well bore and record at the surface the location of the adjacent strings of casing.

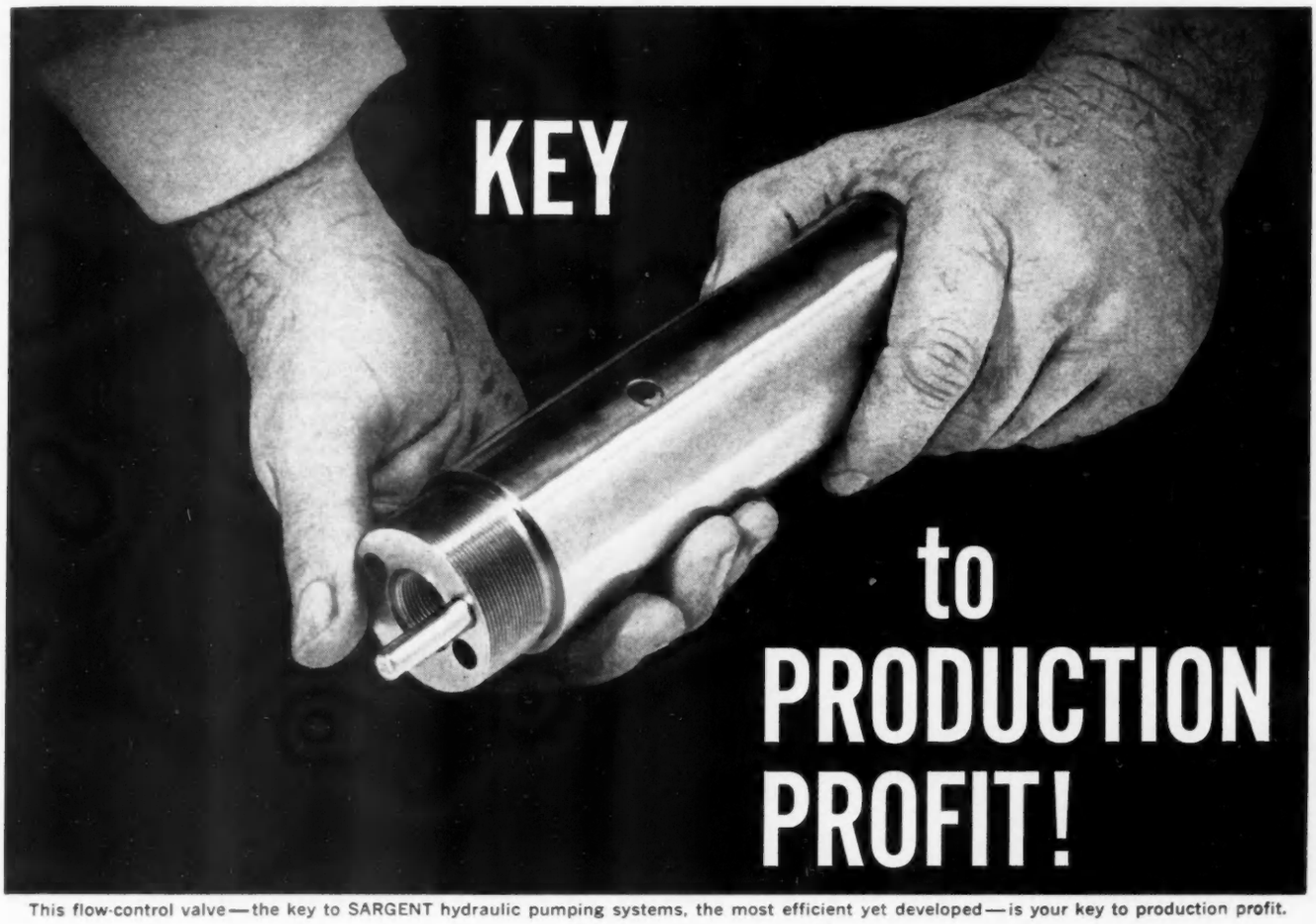
The use of the tubingless completion method has resulted in savings of considerable magnitude through the miniaturization of steel. One operator reported 37 single tubingless completions at depths from 1,400 feet to 10,000 feet and indicated a savings of 19 percent of conventional well costs.

New method of displacing multiple tubing string wells. Displacement of drilling or completion fluids from parallel string dual wells on completion has been time consuming, costly and, in some instances, a hazardous part of rig operations. A tool has recently been developed which enables the operator to install dual production and well head equipment and complete displacement without requiring the use of wireline tools or tubing string manipulation.

The tool is a hydraulically actuated sliding sleeve valve which is an adaptation of a conventional, wireline operated circulating valve. It employs an expendable, sleeve shifting mechanism which receives an aluminum ball that hydraulically closes the sleeve and is subsequently pumped out the tubing string.

In use, the circulating valve is installed on the long string, positioned between the lower production packer and the upper dual packer. After installation of the tubing strings and wellhead equipment, the production packers are pressure-tested and the completion fluid is displaced by pumping down the long string, through the circulating valve and up the short string. The hydraulically actuated valve is closed by dropping an aluminum ball which engages the sleeve shifting mechanism. An increase in pump pressure denotes valve closure and continued pumping shears the sleeve shifting mechanism which is subsequently pumped out the tubing. This sequence is illustrated in Figure 2. In this manner, complete well control is maintained throughout the operation.

Abrasive jet perforating. A new method of establishing perforations in cased holes has been developed recently. The tool employs abrasive-



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4. Unrestricted application because the pump can be used on any well or on more than one well in group operations.
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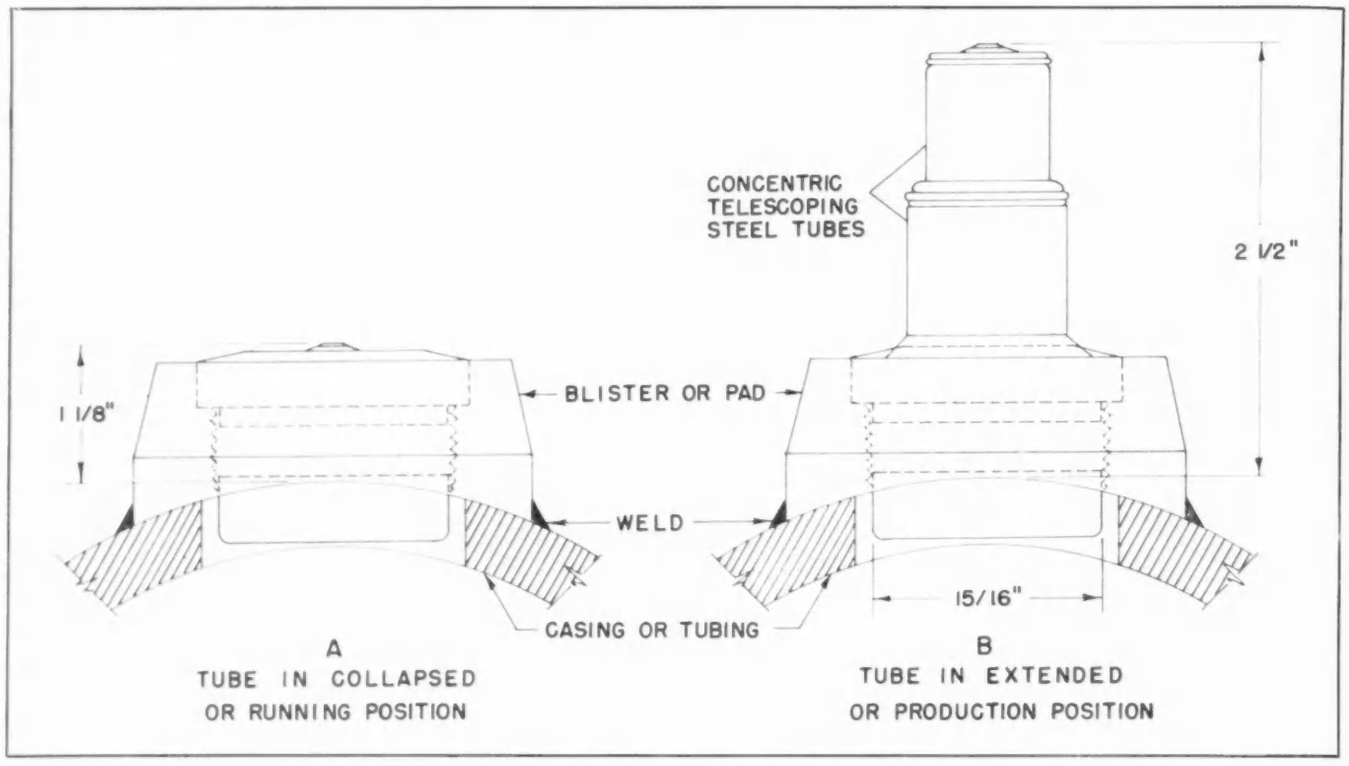

FIGURE 3—Perforation now can be installed on pipe prior to running casing. Figure 3A shows a built-in perforation installed in the closed position; 3B shows the tube extended in the producing position.

laden fluid (sand) pumped at high velocities through small jet orifices. The gun, run on the bottom of tubing or drill pipe, is equipped with four horizontally directed 3/16-inch jet orifices in one plane and three in another. By incorporating a sliding cylinder, only one row of jets is in use at any one time. The stage balls dropped at proper intervals close the worn jets and open a new row of uneroded jets during each stage of perforating.

Perforating tests of the procedure were conducted on a section of 5½-inch OD J-55 casing cemented between a 12-inch limestone block and 12-inch sandstone block. The cement sheath (approximately one inch thick) and the sandstone block were penetrated in 7 minutes and 58 seconds. The limestone block was penetrated approximately 9½ inches in the same period of time.

In field use, the jets are positioned at the bottom of the zone to be perforated and are traversed upward. A mechanical collar locator is usually employed to aid in properly locating the gun. The gun may also be used to notch casing and formation horizontally or vertically for hydraulic fracturing operations.

Perforations run on casing. This new method of well completion is based on the use of small telescoping tubing attached to the well casing in a collapsed position. Each tube is installed on the casing through use of a threaded housing, shop-welded over 2-inch drilled ports in the pipe wall (Figure 3). Spacing and density are at the discretion of the operator. Conventional models employ a tube ½-inch in diameter with an orifice of 7/16-inch.

In operation, the casing is run to the desired depth with the "built-in" perforations spaced opposite the pay zone. Utilizing the two plug process, cement is pumped down the casing followed by a sufficient volume of acetic acid to cover all of the collapsed telescoping tubes. The plug separating acid and cement is lodged in the float collar, and the attendant increase in hydraulic pressure (normally 1,500 psi) causes the telescoping tubes to extrude through the wet cement and make contact with the face of the pay zone. The action of acid upon the friable sealing plugs and diaphragms open the extruded tubes to the formation.

Elimination of cement shattering and prevention of carrots and debris are considered advantages. Principal disadvantages lie in correlation of the telescoping tube section with a proposed interval and the fact that the size of the hole necessarily controls closely the size casing which may be run.

Sub-sea completions. The drilling of exploratory wells from floating vessels has many desirable features, the principal one being decreased investment costs for the operator. Field experience gathered so far in this type of operation has resulted in some

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unique developments in sub-sea well completions.

One approach to sub-sea completions utilizes a unique safety joint arrangement which permits installation of the sub-sea wellhead equipment under complete well control. In this operation, the sub-sea well completion head with flow control manifold and necessary safety devices is run with the surface casing. This assembly lands inside the mandrel of an automatic casing safety joint of the conductor casing at the ocean floor. Upon completion of drilling and subsequent logging, the production string of casing is run under full well control, landed and sealed in the sub-sea wellhead.

Tubing is run and spaced out with the tubing hanger and mechanically operated master valve positioned in the wellhead. The weight of the tubing string automatically orients and aligns the side outlet of the tubing hanger and master valve with the side outlets in the tubing wellhead. The upper section of the tubing hanger and master valve section also serves as the mandrel section of an automatic tubing safety joint. The safety joint is used to land the master valve and tubing head in the sub-sea wellhead assembly as well as provide access to the tubing bore from the surface. Rotation of the access tubing from the surface operates the master valve.

After completion of the well, a tubing plug is installed in the mandrel section of the tubing safety joint above the side outlet of the master valve. Blow-out preventers may then be removed and a completion cap is lowered onto the sub-sea wellhead and automatically latched.

The completion cap serves as a final seal for the wellhead and is equipped with a buoy line to act as a well marker and guide in the re-entry of the well. Exterior release lugs are provided to allow removal of the completion cap for any subsequent well work.

The vast petroleum deposits and attendant high costs of offshore development are causing operators to search for new and unique methods for offshore development. The preceding is an example of the progressive thinking and developments which will eventually result in well completions on the ocean floor as an ordinary occurrence.

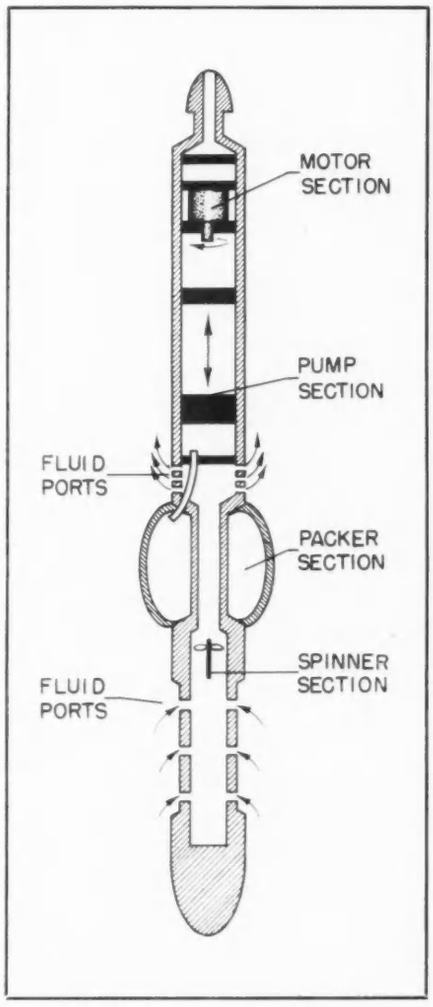

FIGURE 4—Subsurface flowmeters are used to determine flow rates within the well bore. This device can be run through tubing against wellhead pressure.

Nitrogen as a drill stem test cushion. The use of nitrogen in oil field service has now been extended to its use as a control blanket in drill stem testing. This inert gas has proved to be a valuable aid in obtaining uncontaminated formation samples, surface flow control and positive protection of the drill stem.

If hydrostatic mud pressure is not excessive, the entire drill stem is pressured from the surface before the packer is set and the bottom-hole testing valve opened. As the tool is opened, the nitrogen is slowly bled off at the surface where the desired flow rate may be controlled by the engineer. The absence of the sudden pressure shock at the face of the formation has reduced sloughing of the formation and minimized packer failures.

Where hydrostatic pressures are such that protection of the lower section of the drill stem must be provided, a nitrogen control valve is used. The valve is installed in a shearpin sub and is similar in operating principal to a pressure charged gas lift valve. This special tool permits pressuring any desired length of drill stem to the pressure required for protection from collapse. If formation pressures are 10 to 20 psi greater than the nitrogen cushion when the drill stem test tool is opened, the control valve will open allowing entry of formation fluids.

Use of the nitrogen cushion is advantageous where the fluid recovered is formation water inasmuch as there is no dilution of produced water with cushion water.

Other practical uses of nitrogen as an oil field service item are found in its use as a displacement fluid in well completion, a tracer in water flood operations, a means of testing safely high pressure producing equipment, and its use in a process to shut-off water in air or gas drilling.

RESERVOIR ENGINEERING

Subsurface flowmeters. This instrument determines the rates of flow within the well bore below the tubing and is used not only in "problem" wells but also to determine the flow rate profiles of normal producing wells. The flowmeter, shown in Figure 4, was designed to run through tubing on a small diameter single conductor cable introduced into the well bore against wellhead pressure.

An inflatable packer is actuated at any desired depth from the surface by a small motor driven pump contained within the instrument. The packer forms a positive seal between instrument and well bore in 5-inch or 7-inch casing, and diverts the flow of fluids below the packer through the metering section of the device. The single conductor cable transmits impulses from a spinner-type flow detector. The sequence and rate of impulses are transcribed into direction and rate of flow.

In field service, the instrument has provided invaluable information in problem wells suspected of having plugged perforations or other me-

chanical troubles. However, of more consequence was the result of flow surveys conducted in normal producing wells. Here, it was found that in many reservoirs with long perforated intervals a large percentage of the total produced fluid came from a relatively thin zone of the perforations.

The information derived from subsurface flow surveys should be an invaluable aid to the reservoir engineer in the analysis of reservoir behavior, and play an important role in maintaining proper production practices.

Automatic surface recording of bottom-hole pressure. The increasing importance of adequate and accurate subsurface pressure data has resulted in the development of a surface-recording bottom-hole pressure gage. The instrument utilizes a permanently installed vibrating wire-type transducer built for installation on the production string.

An insulated single-conductor cable attached along side of the tubing provides surface communication with the transmitter. An electric impulse from the surface causes a stressed wire to vibrate which, in turn, induces a damped sinusoidal voltage. Changes in stress in the wire, as a result of a pressure change, causes a change in the frequency of the signal measured at the surface. This change in frequency is measured and recorded directly in psi by a pressure recording device. Pressure measurements have been obtained with an accuracy of 0.2 percent.

Application of the instrument provides pressure data in an accurate and convenient manner for those requirements where the advantages of protracted operation and surface recording are a desirable feature.

Drill stem logging tool. A recent development offers to the industry a method permitting electric logging of newly drilled formations. The tool consists of a self-contained battery powered recording mechanism with a flexible electrode (wand) attached at its lower end.

The instrument is pumped down the drill stem whenever a log is desired. The instrument body rests on a stop inserted between bit and drill collar. The flexible electrode is guided through one of the water courses in the jet bit and projects into the open hole below. The tool is equipped with a standard core-barrel fishing neck to facilitate recovery of the instrument, or the tool may be recovered by pulling the drill stem.

Conventional resistivity and self potential measurements recorded on magnetic tape are obtained during a logging run and as much as 3,000 feet of hole can be logged in one pass of the instrument at normal hoisting rates. Depth information is recorded on tape and correlated with drillers depth. The recorded data is played-back at the surface to obtain a proper record of the log.

Some of the major benefits of this tool are reduced logging costs, improved formation evaluation and reduced hazard of lost hole while logging.

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WELL STIMULATION

Hydraulic fracturing. A new approach to hydraulic fracturing has been made through the use of a single, high flow capacity fracture initiated by a "notch" at the formation. In this system, the hole is normally cased and the notch is effected through the use of a modified underreamer or an abrasive-jet type perforator. Based on the particular well and reservoir conditions and laboratory data, each fracturing program is designed as to type of fracturing fluid, propping agent, size and quantity of propping agent and minimum fracture radius to produce the optimum flow rate.

The hydraulically induced fracture is formed at the notch and is extended out into the formation. Proper treatment design results in a high flow capacity fracture. Laboratory studies, as well as field use, have shown that this method of hydraulic fracturing has resulted in considerably increased flow rates—as much as 100 times greater than rates achieved previously.

PRODUCTION INSTALLATIONS

Tank battery design. A new tank battery design incorporating shop-fabricated producing facilities unitized on a single skid has been developed to eliminate excessive lease storage and over-design of oil handling equipment. The unit is standardized with regard to capacity and employs the continuous measuring system of automatic custody transfer. It is estimated that the facility can be installed for approximately 50 percent of the cost of a conventional tank battery.

Well manifolding, oil and gas separator, free-water knockout, heater and a power driven centrifuge for oil treating are incorporated in the skid mounted unit. Also, a test separator is included on the unit as well as the necessary metering devices and associated equipment for a continuous automatic custody transfer system.

Positive displacement meters and positive volume measuring tanks have adapted themselves well to unitized lease production facilities. Both methods have shown high accuracy in fluid measurement and are relatively small in size. A centrifuge was used for oil treating purposes to eliminate the error incurred in metering BS&W and because of its compactness.

A field test of the centrifuge for oil treating denoted a definite range of G forces which each oil can tolerate. If G forces are too high, solids (such as paraffin and asphaltines) are separated from the crude and settle in the centrifuge bowl. If the G forces are too low, the water is not adequately removed from the oil. Sand production has posed a problem for the

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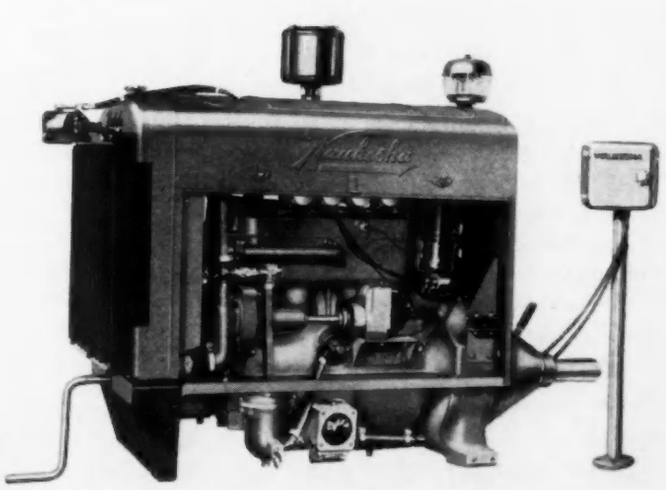

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PHOTO BY JIM THOMAS

centrifuge, since sand retained on the centrifuge bowl must be removed manually.

ARTIFICIAL LIFT

Triple zone pumping. A triple zone pumping installation has been successfully run which incorporates the unique feature of three insert pumps run in tandem on a single string of hollow sucker rods. The system employs a permanent production packer to separate the lower and middle zones and a retrievable hook-wall packer to separate the upper and middle zones.

A string of 2-inch tubing houses the hollow sucker rods and serves as a conduit for the middle zone fluid. A parallel string of 1-inch tubing seats in a cross-over shoe attached to the 2-inch tubing above the uppermost production packer. The 1-inch tubing serves as a conduit for fluid produced from the lower zone and the upper zone and is produced through the hollow sucker rods.

The three insert pumps are run on 7/8-inch hollow sucker rods as a single unit, and are seated as one pump. The lower pump consists of a bottom holddown and a stationary plunger with a moving working barrel which is connected to the middle pump by 3/4-inch sucker rods. The middle pump employs a stationary working barrel and moving plunger. A compound ratio pump is used as the uppermost pump. All pumps are actuated by a single pump jack at the surface.

WELL EQUIPMENT REPAIRS

Glass-fabric-plastic casing patch. A new method has been developed to effect field repairs of casing leaks. The tool is basically an inflatable rubber mandrel which forces plastic-impregnated glass fabric against the inside of the casing at the point of failure. A seal is formed inside the casing with the excess plastic being forced out the casing leak.

As in any casing repair job, this method requires that the hole be located accurately. An area approximately 15 feet above and below the damaged section of casing then is cleaned of scale and paraffin by a special brush assembly run on tubing. The expandable mandrel, coated with a mold release agent, is wrapped with fabric saturated in catalyzed plastic and lowered into the well bore on tubing. When the mandrel is centered over the casing leak, it is expanded by pump pressure. Pressure is maintained a sufficient length of time to allow the plastic to harden. Tubing and mandrel are removed from the well to complete the repair job.

Existing tools permit placement of a patch 10 feet in length with a reduction in internal diameter of 0.3 inch. The patch has been successfully tested at pressure differentials from 2,000 psi to 5,000 psi.

CORROSION

Plastic-coated pipe. A new product offering protection from external corrosion has been made available to industry. The coating is an extruded polyethylene applied at the pipe mill and ranges in thickness from 0.025 inch and up. The coating is applied by first removing any scale, oxide or foreign matter from the pipe. An adhesive undercoating is then hot applied over the pipe and a high density polyethylene hot extruded over the undercoating.

Laboratory and pipe line field tests have indicated favorable results in the use of this type coating. The "live" elastic undercoating and the resiliency of the outercoating allows short radius bends and normal abuse in installation without cracking or destroying the bond between pipe and coating. The polyethylene coating also has low moisture absorption and low conductance. Field joints are made with pressure sensitive tapes and primers.

CONCLUSION

The preceding discussion has covered a number of producing industry developments which were introduced and/or proven during 1959. All should play an important role in reducing costs and increasing operational efficiency during the coming year. Although these advancements are impressive, industry must realize that in order to keep pace with the national progress and its ever increasing demands for energy, future developments must be far greater than those of the past.

About the Author

Richard J. Goeken received a B.S. degree in petroleum engineering from the University of Oklahoma in 1950. Upon graduation, he joined Gulf Oil Corporation as a petroleum engineer. He has spent most of the past seven years in production engineering work in South Louisiana. He gained early experience in concentric tubing workover techniques and has published an article on the subject (WORLD OIL, April 1958, Page 135). He is a member of the Society of Petroleum Engineers and the API. He is presently area petroleum engineer for Gulf in New Orleans.

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Exploration Outlook 1960

Paradox Basin, Las Animas Arch, Sacramento Valley and Louisiana Miocene getting strong play. Offshore activity to spurt in California and the Gulf Coast

IN SOME AREAS, particularly the Paradox Basin, coastal and offshore Louisiana, and central Kentucky, exploration prospects are very bright. Leasing and drilling activity are expected to reach high levels. This is true in the Louisiana offshore, despite triple cost levels compensated only by 50 percent higher crude oil allowables than onshore.

In many other provinces in the United States, *market conditions* seem to govern the anticipated wildcat drilling pace in many areas, particularly in Texas. The expectation of new gas pipe line outlets is expected to spur drilling in the Val Verde Basin, typical of many areas previously retarded by lack of gas markets.

Where few (or no) new shallow horizons have been found prospective, the trend toward deeper drilling continues. In other areas, especially central Kentucky and the Illinois Basin, a trend toward shallower plays is evident. Relatively good market conditions play a part here also, in addition to the cost advantage of shallow production.

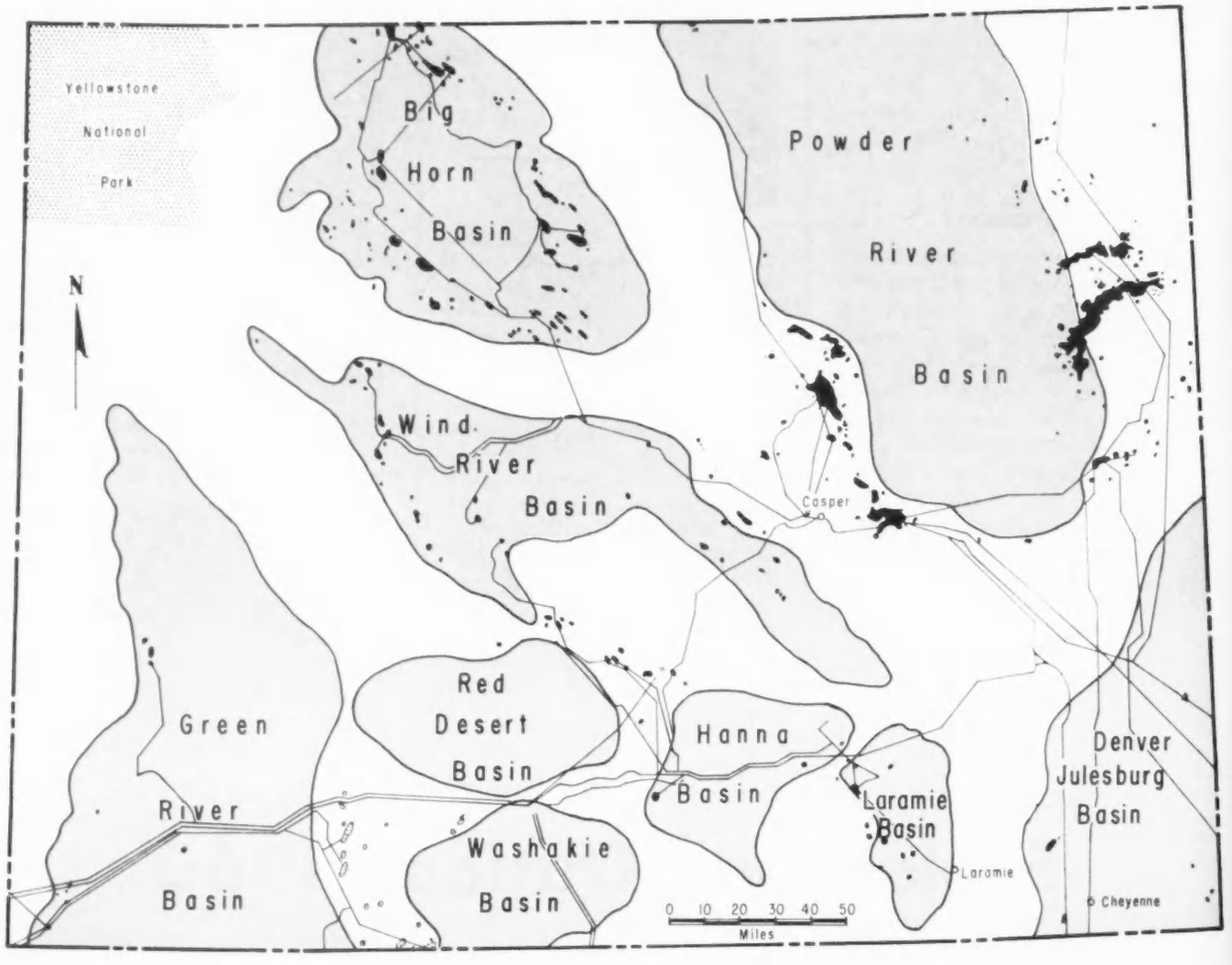
GULF COAST

South Texas Tertiary. Exploratory activity in the southern coastal counties is expected to remain fairly strong in 1960, enhanced by generally good gas markets. The most important trend remains the Frio, through a group of coastal counties, Victoria, Refugio, San Patricio southwestward through Hidalgo into Mexico. Important new gas reserves at depths of 5,000 to 11,000 feet continue to be found.

Increased interest has been shown in down-dip Wilcox gas prospects. Two good gas-condensate discoveries have been made recently, both in lower Wilcox. Both wells were potentialed at 11 million cubic feet daily or better, plus 20 or more barrels of condensate per million.

A lower Wilcox discovery in Jim Hogg County came in at 80 MMcf daily and 20 barrels of condensate per million at 9,500 feet. Important lower Wilcox gas finds also were being made in De Witt County. Hence, all

Sedimentary Basins, Oil and Gas Fields of Wyoming



(See Page 174)

the lower Wilcox trend counties may expect increased attention for gas prospects in 1960.

Upper Texas Gulf Coast Area. Activity will continue in four main Houston area trends in the following probable order of intensity: Frio, Yegua, Wilcox and Miocene.

Frio. Most of the Frio exploration money will be spent on three types of deep plays, as follows.

1. Lower Frio (below *Text. Miss.*) upthrown fault trap (depositional faulting). Typical of this type trap are recent discoveries at Pheasant and El Moton fields, Matagorda County. Upper Frio and younger beds usually dip regionally southeast, masking deeper (9,000-13,000 feet) lower Frio north dip caused by southward thinning within separate fault blocks. This play will extend westward into Brazoria County.

2. Upper and Middle Frio (*Cibicides Hazzardi* through *Nodosaria blanpedi*) accumulation, generally upthrown to down-to-coast faults of from 60 to 2,000 feet of throw. This type play is typified by Palacios field, Matagorda County, and the Green Lake-Alta Loma complex of western Galveston County. Extensions, both east and west, mainly at 9,000 to 13,000-foot depths, will be made in this trend.

3. Hackberry (upper Frio) and upper Vicksburg accumulations from large sand lenses on eroded Vicksburg structure flanks. Port Acres and Port Arthur fields, Jefferson County, characterize this play. Middle and lower Frio beds are absent in portions of Jefferson, Chambers, and Orange counties, and the Hackberry unconformably overlies an eroded Vicksburg surface. Erratic Hackberry sand deposition, deep drilling (11,000 to 15,000 feet), and high pressures involved in this play make it very risky. Success, however, is often rewarded with major gas reserves.

Salt dome flanks will continue to be explored. A few 15,000-foot wells may be drilled seeking Frio sands downdip from productive areas (e.g., south Old Ocean area, Brazoria County).

Yegua. Exploration in an established trend from Fort Bend through Newton County will continue at depths from 5,000 to 10,000 feet. Main production here is from domes, downthrown low-relief coast faulting, and stratigraphic accumulation on low relief structures or noses. Most 1960

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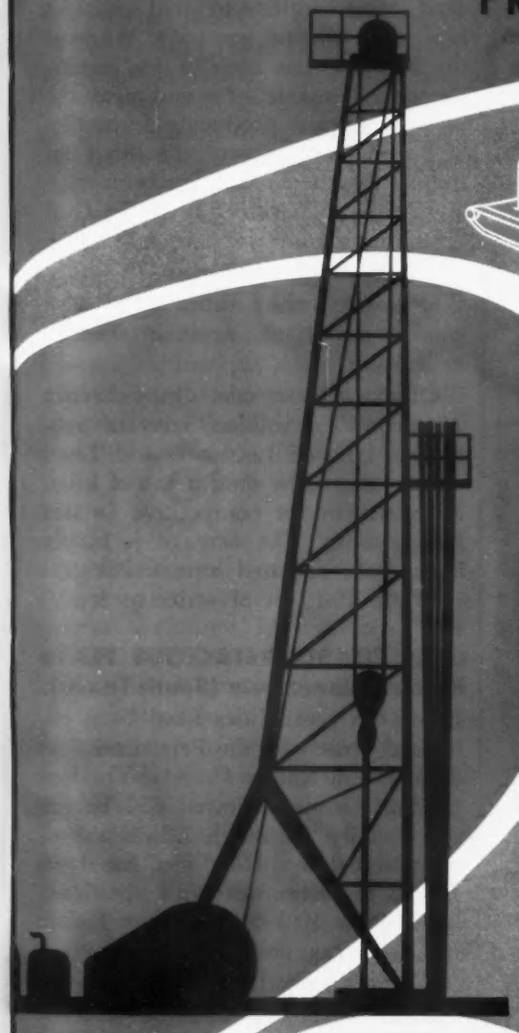

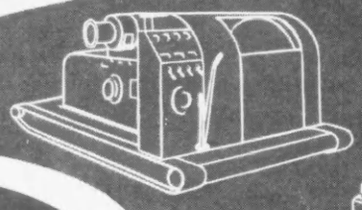

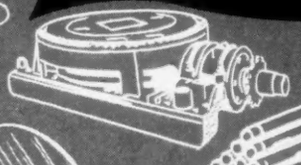

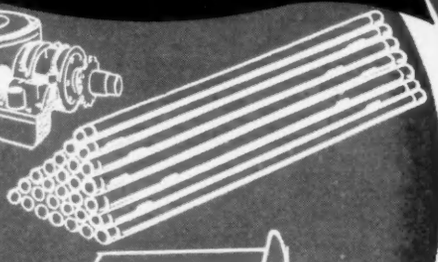

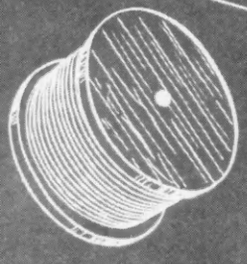

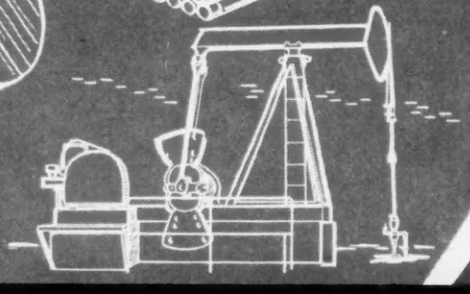

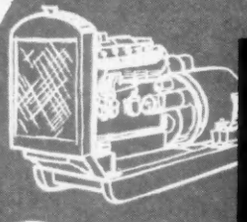

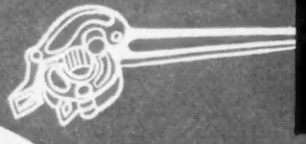

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Yegua exploration money will likely be spent on downthrown structures in the east half of the district.

Wilcox. Upper Wilcox trend exploration should continue at about the same pace, with Colorado and Lavaca counties being drilled fairly intensively. Low-relief anticlines, some of them faulted, are primary traps. More deep middle and lower Wilcox probes, below 10,000 feet, will be drilled. Some new production may be found in San Jacinto, Polk, and Tyler counties in stratigraphic accumulations on low-relief features, with additional closure developing with depth.

Miocene. Scant attention to the Texas Miocene trend is expected during 1960. Onshore in the Houston district, the Miocene has been commercially disappointing. Main exceptions are High Island and Corpus Christi fields. Many structures have been barren at the crest.

Offshore activity will be limited in Texas also due to high costs and low success ratios to date (George F. Watford, consulting geologist, Houston).

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South Louisiana. Strong activity will continue here. Offshore, many untested structures remain, many of them salt domes with prolific oil and gas reserves. Onshore, most salt domes have been largely developed, but interdomal faulted structures and thick sand lenses continue to yield lucrative new deep oil and gas pays. Whereas the Miocene has been of less significance in Texas, it is far and away the most important producing formation in Louisiana. The various south Louisiana Miocene trends have been thoroughly described recently in the Gulf Coast Association of Geological Societies *Proceedings* (1959).

Offshore success ratios have been good in Louisiana, again in contrast to Texas.

Offshore lease sale. On February 24, about 1.6 million acres of submerged land off Louisiana and Texas will be offered by the Bureau of Land Management for competitive (sealed bid) leasing. The acreage is mostly beyond the disputed zone and is generally in 200 feet of water or less.

GULF COAST CRETACEOUS PLAYS

Edwards limestone (South Texas). Edwards possibilities have been enhanced greatly by the Person oil field discovery in Karnes County. The first producer initially flowed 650 barrels of oil daily. Although Edwards production below 10,000 feet has been known for seven years, all significant finds below 10,000 feet before Person had been gas, not oil.

As 1959 ended, a deep Edwards wildcat was being tested in Lavaca County. Unconfirmed reports told of 300 feet of gas-condensate saturated Edwards section. If this find is confirmed, a trend of deep Edwards prospects from Webb and Zapata counties extending at least to Lavaca and probably even farther northeast could be envisioned.

Renewed interest will cause more exploration for Edwards production within the 1,500 to 3,000-foot depth range in the Luling fault zone area on structures heretofore considered to have insufficient closure. Several projects are planned to test the Glen Rose, Sligo, and Trinity formations within the shallow Edwards trend.

Recent oil and gas discoveries in the Rio Grande Embayment in Dimmit, Zavala, and Frio counties have stimulated exploration for buried

altered igneous rock masses ("serpentine plugs"). In the last 40 years, about 33 oil fields have been found in the Balcones-Luling fault zone area in the "serpentine" itself or in an overlying or flanking reef development ("Dale lime"). Recent discoveries have produced from Olmos and San Miguel sands in the Navarro—Taylor group. These sands, reefs in the basal Anacacho formation, and the "serpentine" itself will probably be further explored during 1960. (Kenneth A. Simmons, consulting geologist, San Antonio, and other sources).

Mississippi. Deep wildcat drilling for Hosston, Sligo, and other Cretaceous formations will probably accelerate in 1960 as more subsurface control becomes available and new prospects are developed. Fairly good market conditions for Mississippi crude also enhance deep wildcat activity.

Florida. The oil search is extending offshore as the search for substantial reserves continues. Limestones of Comanche age, particularly the Sunniland (Glen Rose equivalent), remain the primary target.

Three test wells were drilled on State tidelands during 1959. Near Key West, Gulf Oil Corporation State Lease 826Y 1 recovered the first offshore oil in Florida on a drill stem test of the Comanche. Gulf and The California Company acquired 132,480 acres of outer tidelands last year, comprising 23 of 80 blocks located between Marquesa Keys and Dry Tortugas, 25 to 65 miles west of Key West. Drilling is slated for early 1960 in 40 feet of water about 15 miles southwest of Marquesas Keys (an extremely rank wildcat location). (Joseph E. Banks, chief geologist, Coastal Petroleum Company, Miami.)

EAST TEXAS

East Texas is enjoying an over-all upsurge of leasing and drilling activity, spurred by important discoveries in recent years. Hence, vigorous activity is expected to continue in Railroad Commission Districts 5 and 6 in 1960, particularly in areas and trends discussed below.

1. North and northeast portion of the East Texas Basin, extending from Cass County west-southwest to Van

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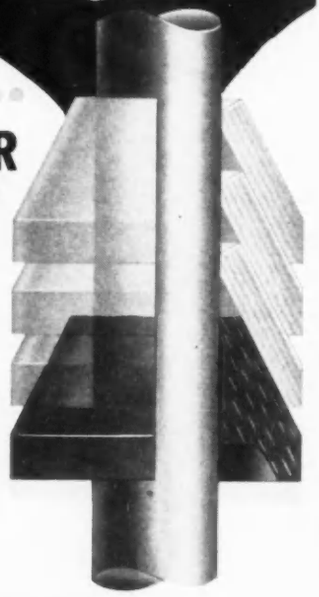

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Zandt County. This area will be explored mainly for deep Jurassic (Cotton Valley and Smackover) structures. A significant Cotton Valley discovery in Cass County in 1959 has accelerated this effort.

2. South portion of Basin, principally Anderson, Houston, and Leon counties. Main objective here is the prolific Woodbine sand. Depths below 6,000 (greater than established Woodbine production) will be penetrated in search of stratigraphic and structural traps. The secondary target is Sub-Clarksville sand, often productive along with the Woodbine.

3. West flank of Sabine Uplift. Additional gas and oil reserves in the lower Cretaceous, mainly Pettit and Travis Peak, where stratigraphic traps and porosity pinchouts are the rule, will continue to be sought.

4. Smith and Wood counties (East Texas Basin portions). Paluxy sand production, primarily from fault traps, will receive much attention. Deeper lower Cretaceous limestone exploration should continue along the flanks of established producing structures.

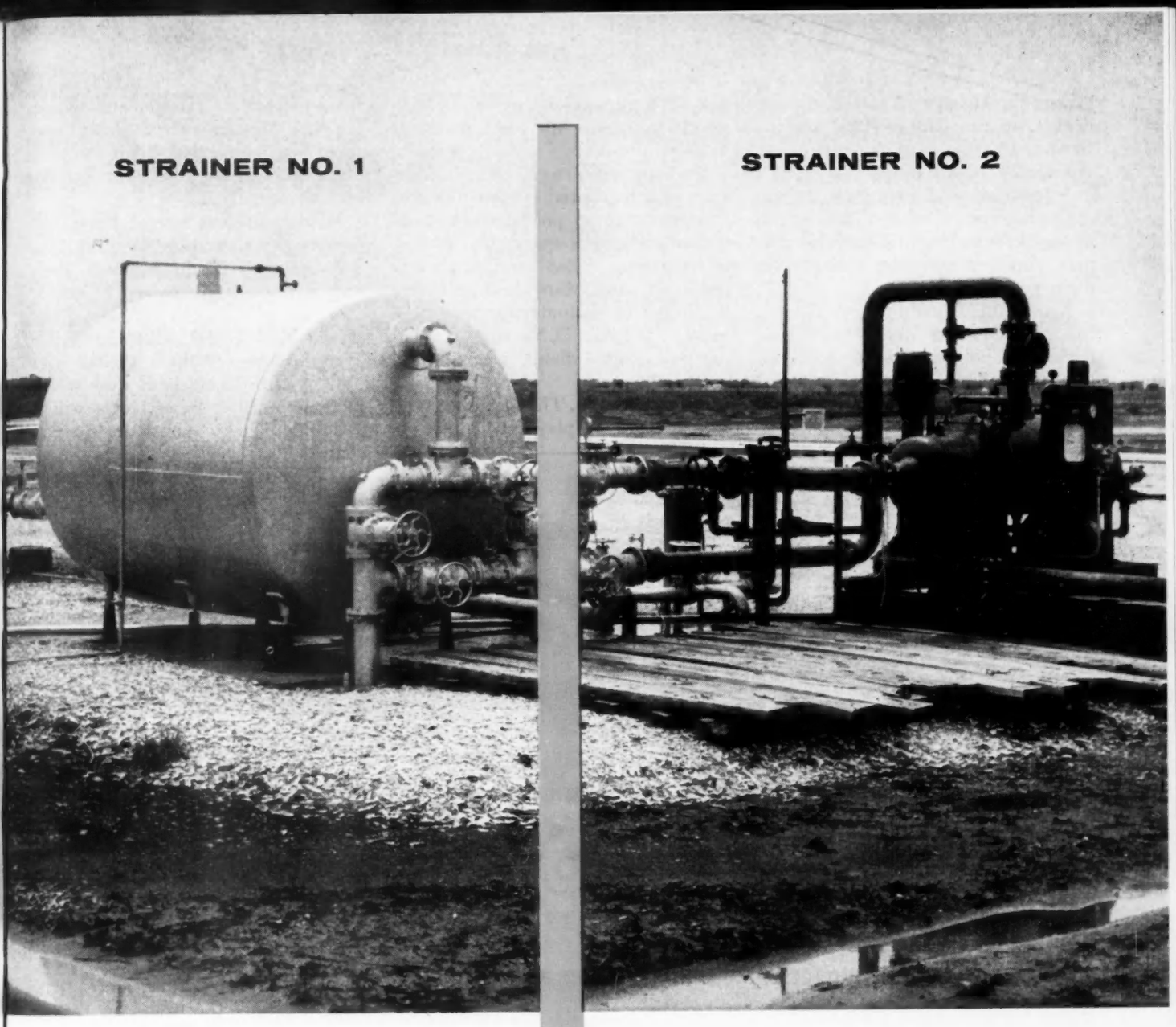
5. Piercement salt domes. Good Woodbine and lower Cretaceous lime production at Bethel dome, Anderson County, and Woodbine production at Oakwood dome, Freestone and Leon counties, will cause drilling of more flank tests on non-producing domes. Most domes are tightly leased.

6. Central Graben area along Mexia-Talco fault trend. Good shallow Woodbine oil production in Trix-Liz field, Titus County, will push the play for similar production in other nearby areas. (John G. Voight, consulting geologist, Tyler, Texas.)

WEST TEXAS

Val Verde Basin and Sheffield Channel. Transwestern's new pipe line, now being built, will provide a badly needed outlet for Val Verde Basin and Sheffield Channel gas production. Puckett gas field, one of the nation's largest, has one very limited pipe line outlet. Brown-Bassett and other Val Verde Basin gas fields have none. New construction will enhance both exploratory and development drilling rates.

Many tests required. Commercial reservoirs have been established in Brown-Bassett in Ordovician, Silurian and lower Permian formations. How-



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ever, only 10 deep tests had been drilled by the end of 1959 on the Brown-Bassett surface structure (nearly 25 miles long).

A recent discovery on the south rim of the Sheffield Channel found gas in upper Permian rocks, indicating that many more prospective horizons remain to be explored.

A substantial percentage of current oil and gas leases in the Val Verde Basin-Sheffield Channel areas expire during the 1960-1964 period. Since prospects are good and lease renewals will generally be difficult and expensive, oil companies are accelerating efforts to localize the more favorable geologic prospects.

Seismic coverage, though widespread, is hampered by generally low quality owing to poor records. Subsurface control is sparse due to lack of deep tests drilled except in a few restricted areas. Many deep tests must be drilled to evaluate prospects adequately. (Charles D. Vertrees, consulting geologist, Midland, Texas.)

Delaware Basin. The Delaware sand wildcat drilling play in Culbertson, Reeves, Loving (Texas), and adjoining New Mexico counties should continue active in 1960. Oil is found at depths of 3,000 to 5,000 feet, and has proved lucrative.

Wildcat drilling activity is continuing in a variety of plays on the Central Basin Platform, Midland Basin and Panhandle.

EAST SHELF PERMIAN BASIN—NORTH TEXAS

Exploratory activity is expected to increase in 1960. Lease blocks will be less difficult to acquire than in recent years.

Chief targets will be stratigraphic traps. Lower Permian and Cisco sand lenses, channel deposits and bars will be attractive shallow prospects. Canyon, Strawn, and Mississippian reef limes and Pennsylvanian sands will be promising targets at moderate depths. The search for gas will continue along the Bend arch and into the western borders of the Fort Worth Basin.

Among the relatively undeveloped "sleeper" areas which may attract attention in 1960 are Hardeman, Foard, and Wilbarger counties in North Texas, and Concho and Menard farther south. (Frank B. Conselman, consulting geologist, Alibene, Texas.)

SOUTHEAST NEW MEXICO

The Abo reef trend was developing late in 1959 and was expected to become very active in 1960. Oil production is being found at moderate depths in the Abo, south of the old Maljamar field.

OKLAHOMA

Current activity is featured by several significant gas discoveries in the McAlester Basin; the opening of a new gas province in the Ouachita Mountains overthrust belt south of the Choctaw fault of southeastern Oklahoma; significant developments in northwestern Oklahoma and Cherokee sand plays in north central Oklahoma.

McAlester Basin. The principal discovery of 1959 was Midwest Oil Company Orr 1, Sec. 8-T6N-R22E, Latimer County, on the west end of the shallow Norris gas field. On a drillstem test the well flowed 17.5 MMcf daily from a 129-foot interval from 7,180 to 7,309 feet in Atoka sandstone (lower Pennsylvanian).

A second important discovery was Sinclair Oil and Gas Company

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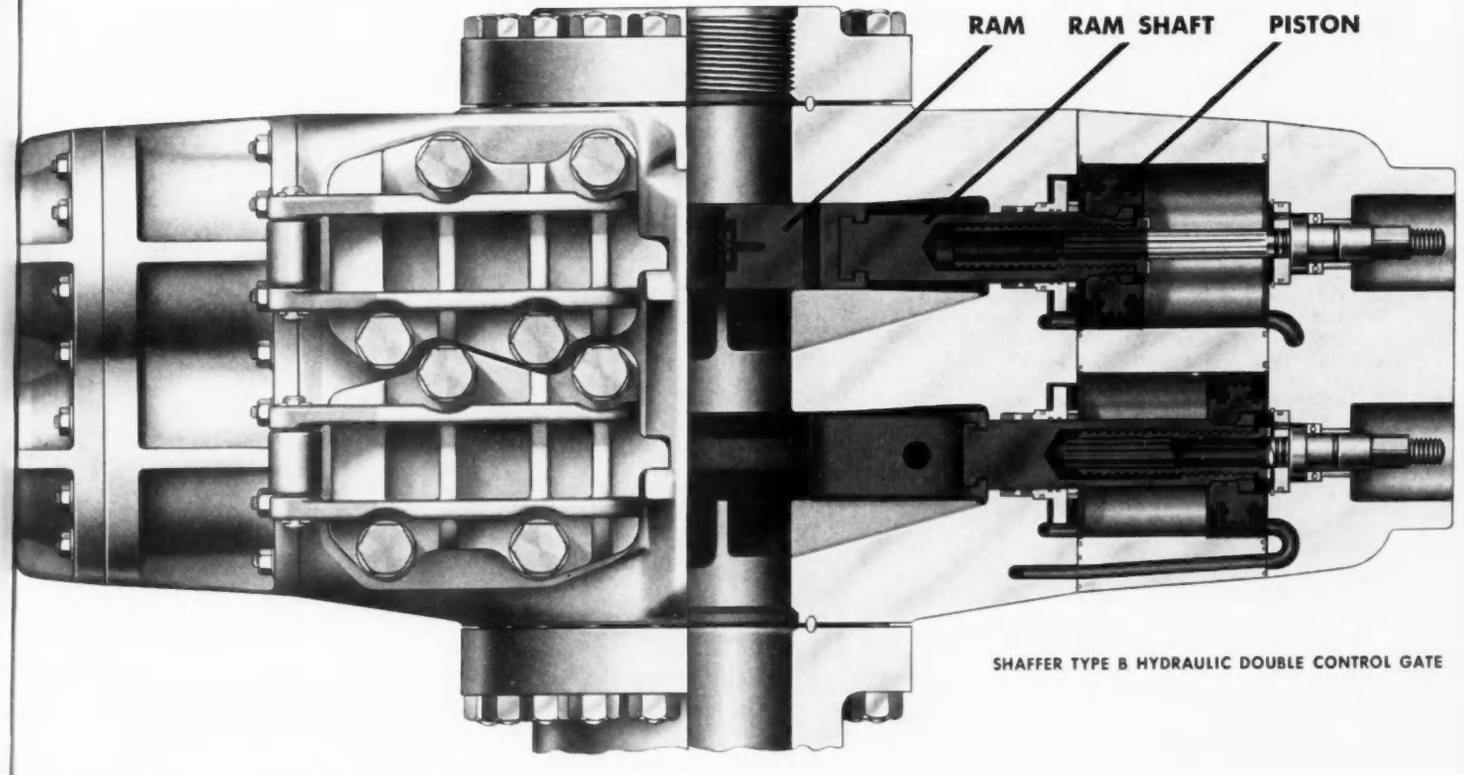
It will pay you to take a long look at the way hydraulic pressure is used to actuate the rams for closing off against well pressure. Be sure you get a hook-up that:

1. ***Has no levers . . . no yokes . . . no complicated connections to jam when emergencies threaten!***
2. ***Has no lever "pockets" where cement or mud can collect to interfere with quick, positive operation!***
3. ***Has no exposed linkage where loose timbers, pipe or other objects under the rig can fall to prevent ram closure!***

In short, be sure to look for direct "In-Line" Ram and Piston Design—the hydraulic piston on one end and the ram on the other end of a single, one-piece, *fully-enclosed* ram shaft!



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Quick, direct and *positive* "In-Line" Ram and Piston Design is just one of *many* important advantages built into ALL FOUR types of Shaffer Blowout Preventers . . .

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TYPE E for general drilling where the quick ram indication of *rising* locking shafts is preferred.

TYPE XHP for extra-high-pressure drilling—to 15,000 PSI *Working* Pressure in 7 1/16" Bore Size . . . to 10,000 PSI *Working* Pressure in 9" and 11" Bore Sizes.

TYPE LWS for portable blowout prevention on quick in-and-out production jobs (weighs only 780 lbs. in 7 1/16" Bore Size).

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- ★ *Cuts Rig Time*
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Ease of operation . . . fastest, most precise bottom-hole orientation in the drilling industry . . . all these benefits are yours when you use the Regan Bottom-Hole Orienting Sub. Field tested for nearly three years in holes up to 12,000 feet by major California drillers, this great new tool is now ready to bring its positive advantages to industry-wide drilling operations.

Featuring a pre-set splined jar one single above the deflection tool, the jar is tripped by a gravity-actuated ball. It indicates *at the surface* the correct tool orientation by shortening the drill string the length of the jar. *At no time does the ball support any weight to bind its movement or damage its race.*

For dependable hole insurance, plus fastest and most precise deflection tool orienting, check into the Regan Bottom-Hole Orienting Sub—soon.

Advantages of deflection tool orientation from the *bottom* of the hole:

1. Absolute accuracy within closest tolerances.
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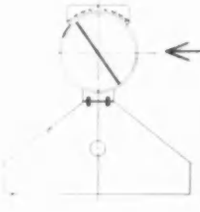
3. Elimination of time-consuming instrument runs; use and wear of sand lines.
4. Will repeat setting as many times as necessary without removing tool from hole.



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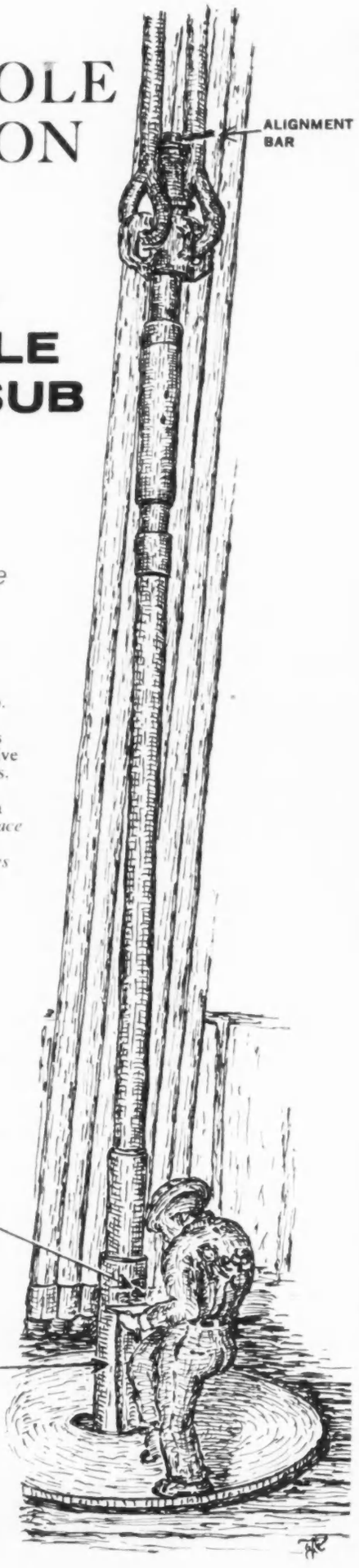
Protractor is placed on whipstock face with hair-line on mirror aligned with the alignment bar in orienting sub for fast, precise surface setting.



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Reneau 1, located south of Laura in southern Latimer County, C SE NW Sec. 32-T3N- R20E. It encountered more than 4 MMcf daily in a 150-foot fractured, vuggy Bigfork chert section above 2,550 feet. The Bigfork is correlative with Viola (Ordovician). Early in December the well found a large flow of gas at about 6,300 feet, where it threatened to blow out from a sandstone series lying in a 70-degree angle.

Of significance in the McAlester Basin proper are several new discoveries. The Hartshorne sandstone has been found productive 12 miles southwest of McAlester in western Pittsburg County. Carter Oil Company Morris 1, located SE SE NW Sec. 24-T5N-R12E reported an open flow of 5,650 Mcf daily through perforations from 3,216 to 3,378 feet.

Other important recent gas discoveries have been made in basal Atoka sandstone in southern Haskell County, and in Atoka and Cromwell sandstones in the Kinta Northeast gas field.

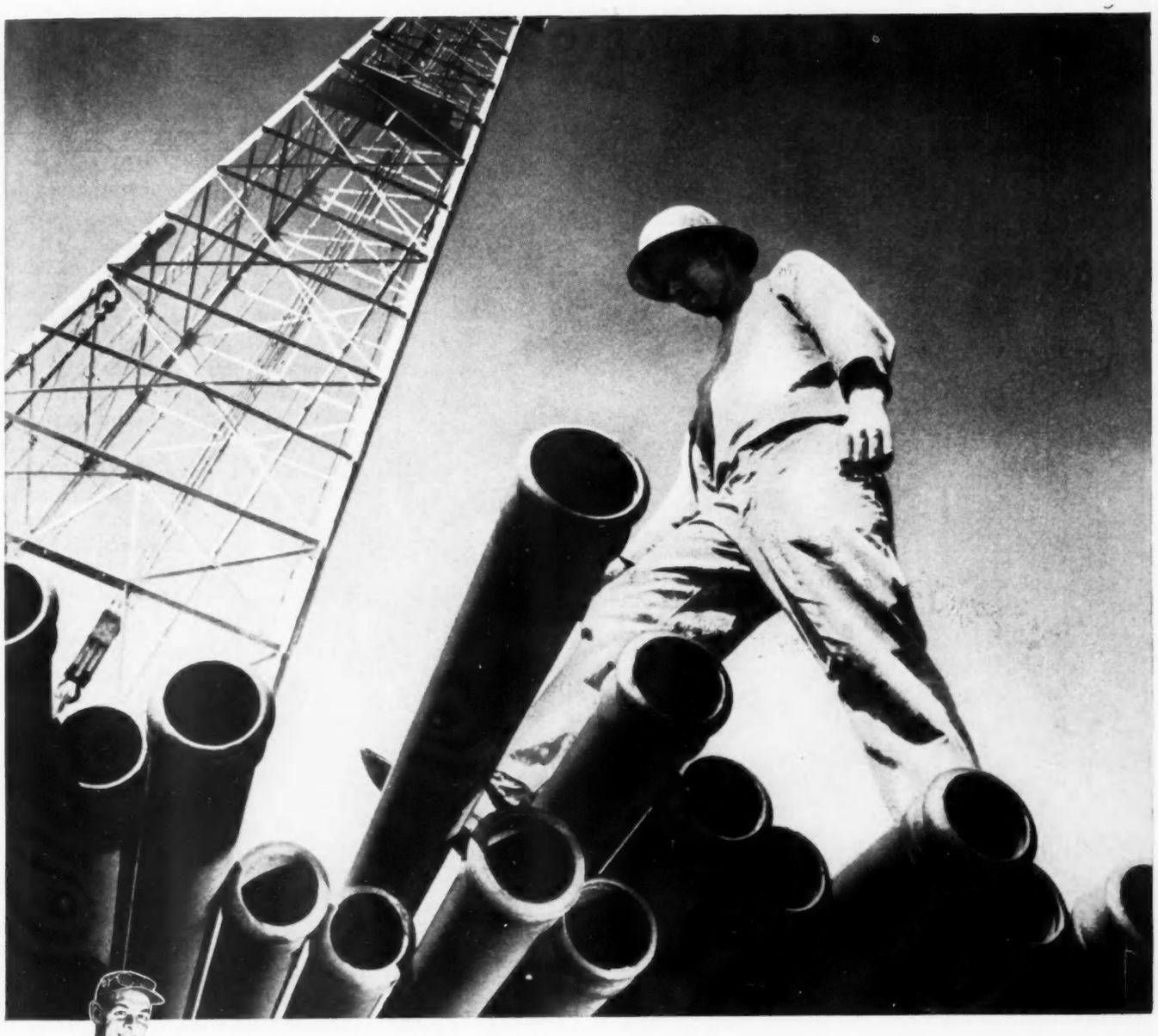
Northwest Oklahoma. High success ratios of gas-condensate discoveries in the Morrow sandstone series in Harper, Woodward and Ellis counties continue in this rapidly-growing producing area on the northern shelf of the Anadarko Basin.

Many lease expirations in 1960 and 1961 will force rapid exploratory activity. In addition to Morrow sandstones, lower Tonkawa, Wabaunsee, and other Pennsylvanian gas sands are prospective. Improved pipe line outlets will also enhance development of this area.

Deep Anadarko drilling. Canadian, Dewey, Ellis, and Woods counties will continue to enjoy an active search for deep gas-condensate pays.

An important Cherokee sandstone series (lower Pennsylvanian) discovery is Sunray Mid-Continent Oil Company Baker 1, located 16 miles southwest of Watonga in Blaine County. Completion was in open hole 10,764 to 10,806 feet, for 41 MMcf daily on choked gages. Indicated condensate content is 68 barrels per million.

Custer County acquired its second field during 1959, at Gulf Oil Corporation Bergtorf 1, C SE NW Sec. 6-T13N-R15W, ten miles southeast of Custer City North field. Completion of a gas well was through perforations



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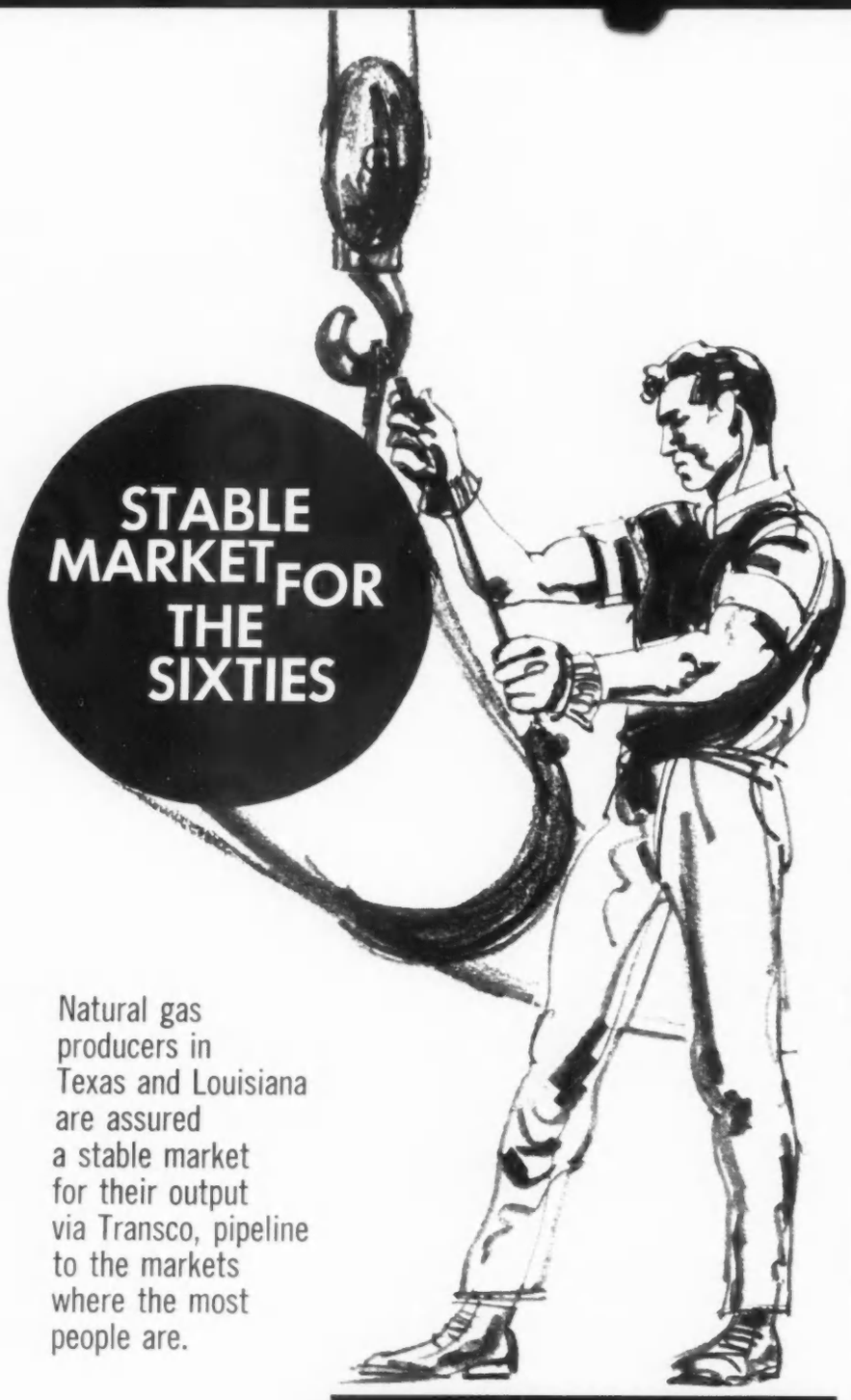

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TRANSCONTINENTAL GAS PIPE LINE CORPORATION

13,356 to 13,378 and 13,410 to 13,425 feet. (Joseph A. Kornfeld, consulting geologist, Tulsa.)

BIG GAS PLAY IN ARKANSAS VALLEY

Exploration in the Arkansas Valley is expected to follow three main patterns: 1. long eastward stepouts attempting to extend Atoka production to the Gulf Coastal plain; 2. a similar type of Atoka play southward toward the frontal Ouachitas; and 3. deeper drilling in shallow Atoka production areas to test older Atoka and underlying Morrow (Pennsylvanian) sections.

The limited Paleozoic play on the south side of the Ouachita Mountains may expand rapidly if evaluation of the initial wells is encouraging.

The south Arkansas oil country probably will be subject to a less vigorous exploratory program than the Valley region. Southern Arkansas has many producing zones in upper and lower Cretaceous and Jurassic sections, with discoveries being made right along in these beds. Predictions as to a specific trend do not come easily in such a situation unless a particular trend is "hot" at the end of the year. (William M. Caplan, state agency geologist, Little Rock, Ark.)

KANSAS OUTLOOK BRIGHT

Cumulative crude oil production has reached 3 billion barrels in Kansas, and the outlook is bright for new discoveries and extensions.

At the end of 1959, there were 10 oil fields with 25 producing wells in the four extreme northwest Kansas counties of Cheyenne, Rawlins, Sherman, and Thomas. Five of the new fields were opened in 1959. As of the end of September, production in these four counties amounted to 186,193 barrels. The Kansas City-Lansing section in this area is expected to continue to be found prolific, and interest in the region will continue for some time. These beds are found here at a little below 4,000 feet. Shallow Cretaceous rocks also may be found to contain oil in northwest Kansas.

Southwest Kansas. Permian rocks contain the great Hugoton gas pool at 2,500 to 3,000 feet of depth. In the same area, older rocks, primarily Carboniferous, are highly oil-prospective. Mississippian rocks are about 5,500 feet in depth. Oil production in this

tubing, is pierced from a solid billet of steel. And only steel of the very best forging properties and of the highest uniformity can be used, since the modern piercing operation tends to seek out any defects in the metal.

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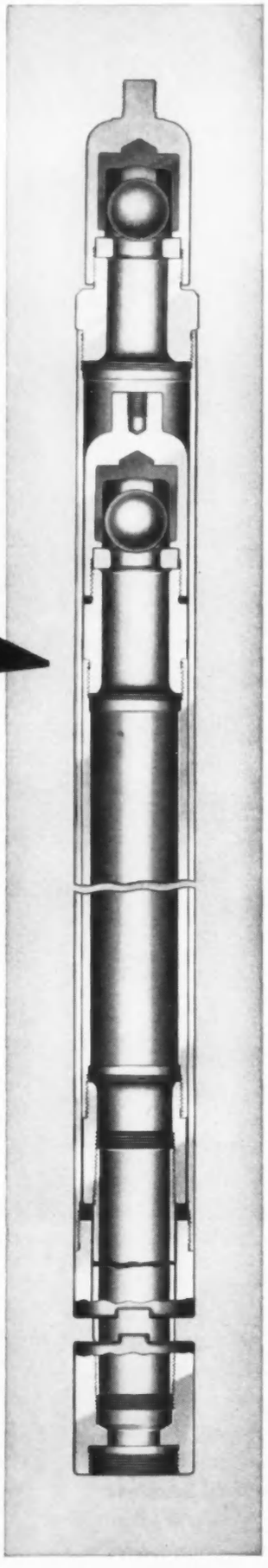

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(southern) part of the Hugoton Embayment is considerable.

Last year's discoveries in the southeastern parts of Riley and Geary counties vindicate continued efforts to find stratigraphic traps on the west flank of the Nemaha Anticline. "Hunton" production is obtained in Riley County, and lower Pennsylvanian was found in Geary, both at about 1,700 feet. Search for similar fields will continue.

Many other plays and areas in Kansas will be active. For example, pre-Pennsylvanian rocks in eastern Kansas remain practically untested by holes located on sound geologic data. (J. M. Jewett, state agency geologist, Lawrence, Kan.)

FIFTY WILDCATS IN SOUTH DAKOTA IN '60

Williston Basin. Continuing exploratory effort in the southern portion of the Williston Basin will be made to test the Ordovician Red River dolomite which produces oil in Harding County, in the northwest corner of the state. Increased attention will be paid to the deeper part of the Basin, 50 to 100 miles eastward. In addition to the Red River target, permeability changes in Mississippian carbonates, which have shown oil in scattered tests, will also be sought. Holes will be drilled for stratigraphic traps along the southern and eastern fringes of the Basin, primarily in Mississippian and Ordovician carbonates; also to check Pennsylvanian shows in older tests.

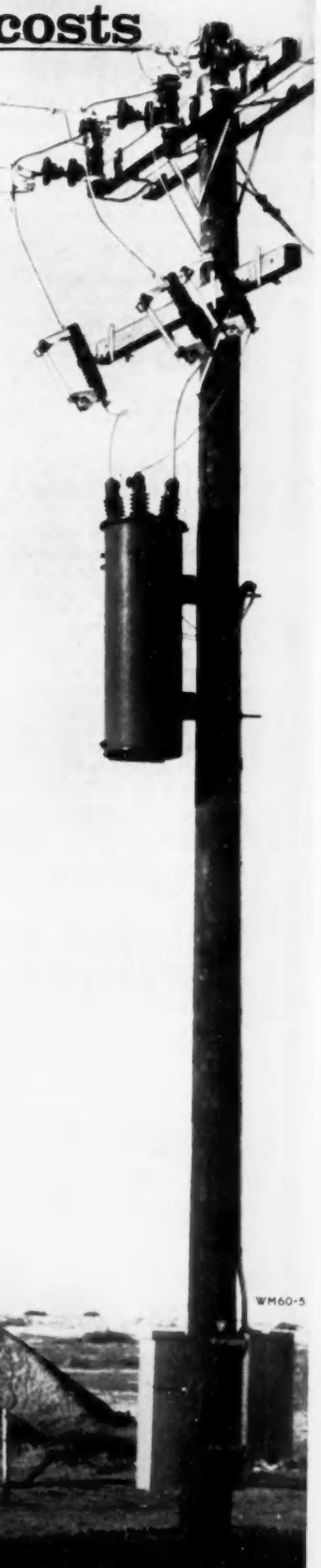
Black Hills fringe. Especially in the extreme northern and southern parts, holes will probe for permeability traps in the Cretaceous Newcastle sand and the Pennsylvanian Converse and Leo sands.

Rank wildcat areas. Among the areas over due for systematic exploration (but which may not attain it for another year or so) are the south-central tier of counties in the Kennedy and Forest City basins (extending northward from Nebraska). (Allen F. Agnew, state agency geologist, Vermillion, S. D.)

DEEP WILLISTON BASIN ACTIVE IN NORTH DAKOTA

In 1960 the most active drilling areas in North Dakota should be in

We've matched a transformer with a motor to cut your oil well pumping costs



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The Wagner motor is engineered specifically for oil well pumping. It has plenty of torque to handle heavy initial loads without laboring or stalling. Its high slip (carefully determined by field tests) enable it to run smoothly under cyclic loads. Class B insulation protects the motor windings, gives greater thermal capacity to absorb the heat from peak loads. It consumes fewer kilowatthours per barrel because of its efficient operation in its specific job. These motors are built in ratings of 5 hp and larger.

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the western part, where the Williston Basin is of greater depth.

Shell "Badlands" discovery. Successful completion of Shell Oil Company Northern Pacific Railway 32-15, located in southwestern McKenzie County, C SW NE Sec. 15, T145N, R101W, has stimulated much interest. The location is 25 miles east of the Montana line and 35 miles north of Medora, North Dakota, along the little Missouri River.

The well was completed in December at 9,400 feet, with total depth at 9,535 feet. A six-hour production test on December 10 averaged 66.3 barrels of fluid per hour with 4 percent water. Oil gravity is 34.8° API. The well has flowed on chokes of ⅛- to ¼-inch. The pay formation is the Mississippian Madison. Location is on the northeast flank of the surface structure. Many similar structures have been mapped in nearby areas.

Mobil Montana discovery. Another important apparent oil find is Mobil Producing Company F-44-20P Mueller 1, located in Sheridan County, Montana, one mile west of the North Dakota boundary 33 miles northwest of Williston.

In December, Mobil was trying to complete this well in the Madison at 8,021 to 8,031 feet. Total depth was at 12,033 feet in Red River. A drill stem test in Madison at 8,000 to 8,162 feet caused recovery of 460 feet of oil and muddy salt water, 2,024 feet of oil, and 2,742 feet of salt water.

If successfully completed, this well could result in an important field astride the North Dakota-Montana border. Little is known about surface structure, however, since most of the bedrock is covered by a mantle of glacial debris.

In December, Shell was drilling an important test along the Cedar Creek anticline extension in North Dakota. Should the well be successfully completed in the Red River, it could be quite significant.

Drilling of wildcats to Madison objectives should continue at the 1959 pace in Burke, Bottineau, and McHenry counties. (Dan E. Hansen, state agency geologist, Grand Forks, N. D.)

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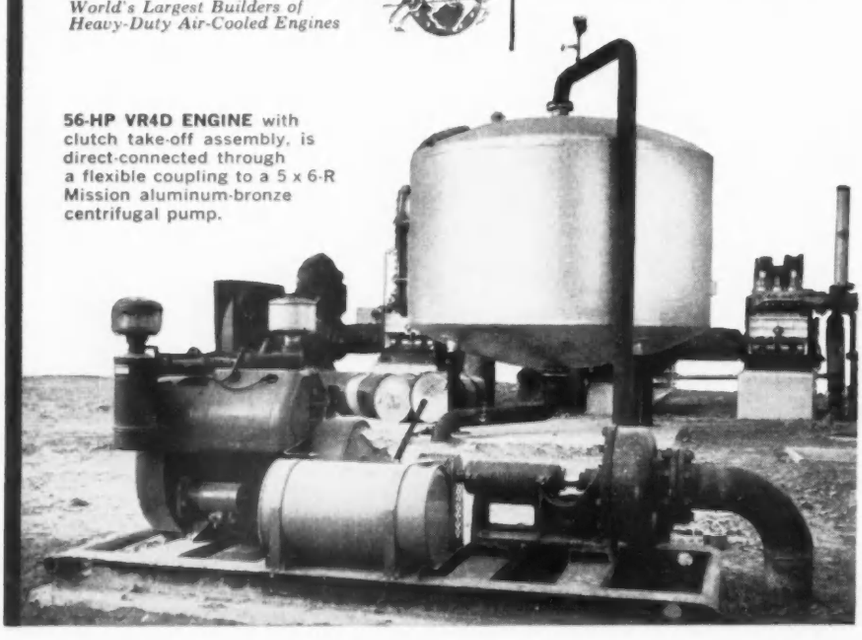

56-HP VR4D ENGINE with clutch take-off assembly, is direct-connected through a flexible coupling to a 5 x 6-R Mission aluminum-bronze centrifugal pump.

ROCKY MOUNTAINS— BIG PARADOX EVENTS

Montana. In addition to extension of various trends, particularly in the Williston Basin from the Dakotas (already discussed), Montana is enjoying a moderate-depth (about 5,300 feet) Tyler sand play in Petroleum and Musselshell counties. This sand is of Carboniferous age.

Wyoming. Oil and gas exploration will continue active in Wyoming in 1960, particularly in the Green River-Red Desert-Washakie, Powder River, the Wind River basin. (See map on page 156.)

Green River-Red Desert-Washakie basins. Successes in gas development from Paleocene and Cretaceous sands along the extreme western margin of this large basin complex have stimulated wildcatting, following the advent of Pacific Northwest Pipe Line as a gas outlet. Deep drilling in old fields and wildcatting in newly-outlined areas of structural interest will continue along a generally north-south trend in the western section.

Significant development of Mesaverde oil and gas sands on the east flank of the Rock Springs Uplift will continue to mark an active area. Discovery of oil at Patrick Draw and West Desert Springs in horizons which heretofore were primarily gas-

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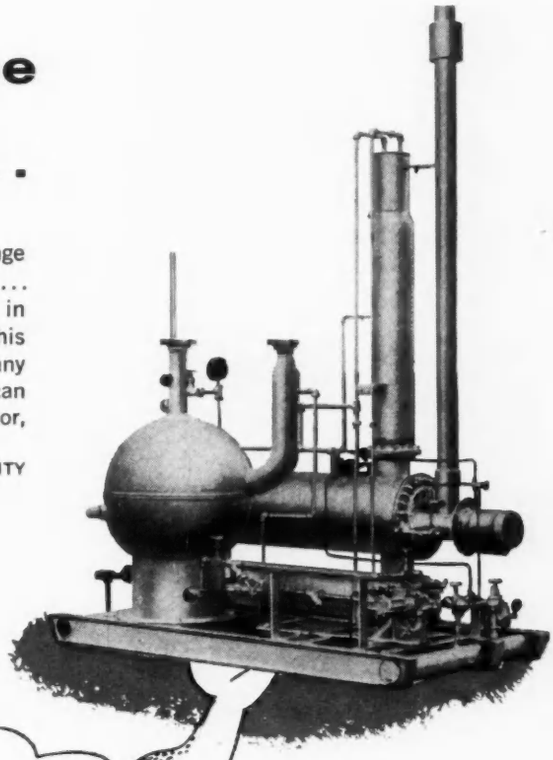

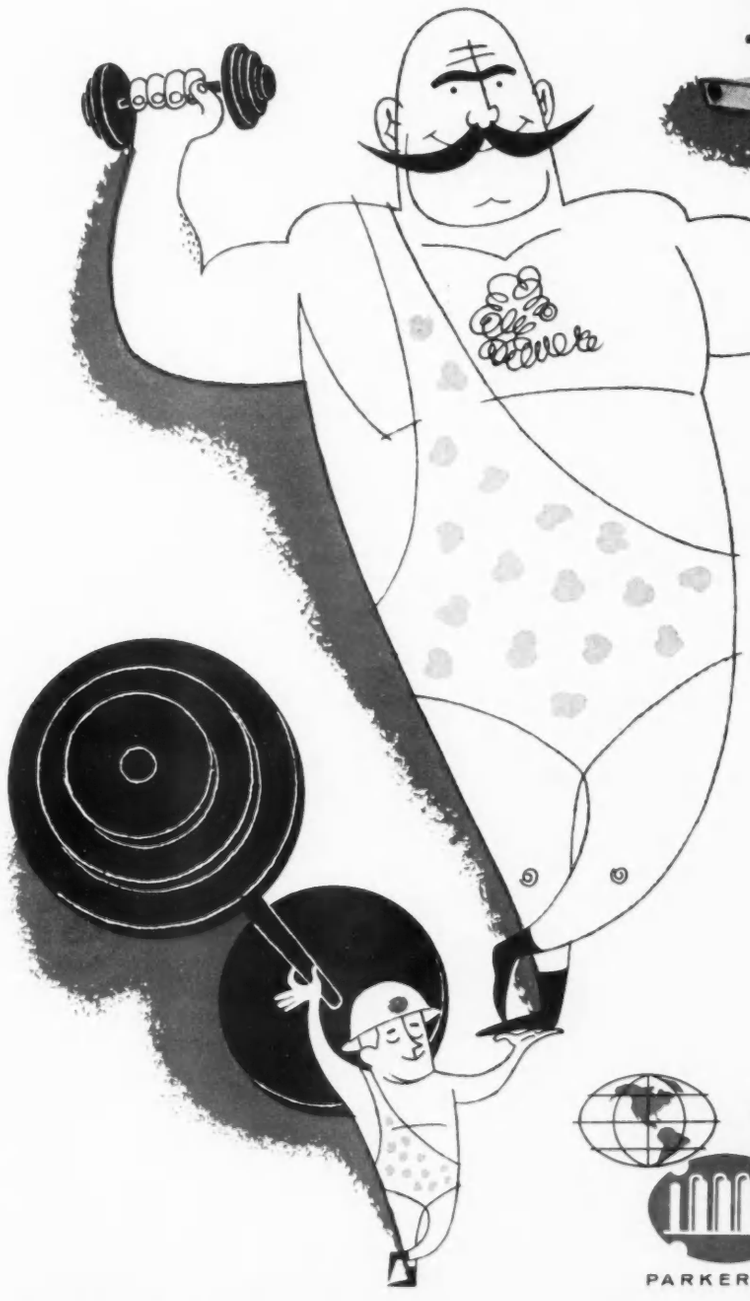

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bearing is a new development which will lead to considerable future drilling.

Scattered Eocene and Cretaceous sand gas discoveries along the eastern margin of the Washakie Basin also establishes a north-south trend which will see further activitiy in 1960. Lack of a pipe line outlet will be a retarding factor, however.

Powder River Basin. In northwestern Wyoming, the east flank of the Powder River Basin has a threefold trend development which will continue active in 1960. The easternmost and shallowest is a Cretaceous-Permian-Pennsylvanian play on the western flank of the Black Hills. The Donkey Creek—Coyote Creek Dakota sand trend will be active also. The search here is for stratigraphic traps in Cretaceous sands. Farther west and deeper in the Basin, Mesaverde sands which show oil and gas virtually all through the Basin will be further checked in 1960.

Wind River Basin. Interest is increasing along the northern rim and well into the central part—areas hitherto thought to be too deep for known lower Cretaceous and Paleozoic objectives. Discoveries of oil in the Paleocene Fort Union formation, and gas in non-marine sediments (Eocene—Wind River formation), have opened new horizons.

In addition, oil completions have been made in Cretaceous Lance sands at Waltman. All of these factors will stimulate wildcatting in more central parts of the Basin.

Lease plays are taking place in deeper parts of the Big Horn and Powder River basins, looking toward shallow Eocene exploration.

In the Big Horn, Laramie, and other Wyoming basins, 1960 will witness the usual probing around edges of known structures, and deep tests. Wyoming is just beginning to have enough subsurface control to guide exploration programs and to recognize stratigraphic variations as they may be related to various types of anticlinal structures. (William H. Curry, consulting geologist, Casper, Wyo.)

Colorado. Wildcatting in 1960 will be generally strong owing to good success ratios in the Rocky Mountains. However, outside of Colorado's portion of the Four Corners area, activity was expected to follow older trends. Development of the "D" and "J" (Dakota) sandstones in the Den-

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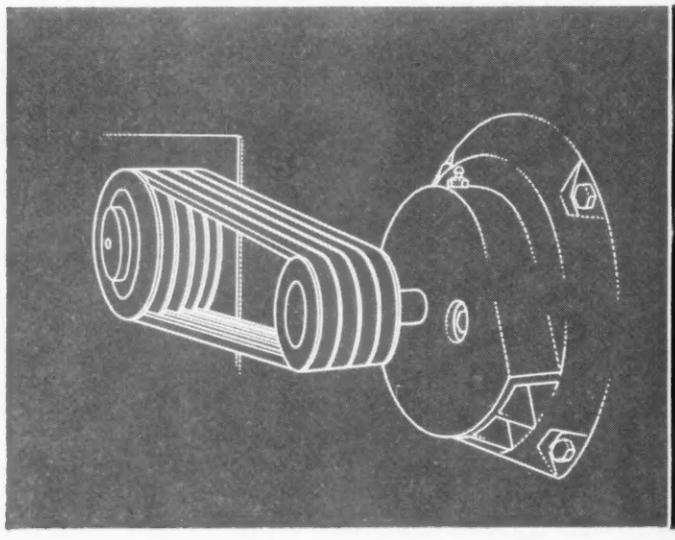

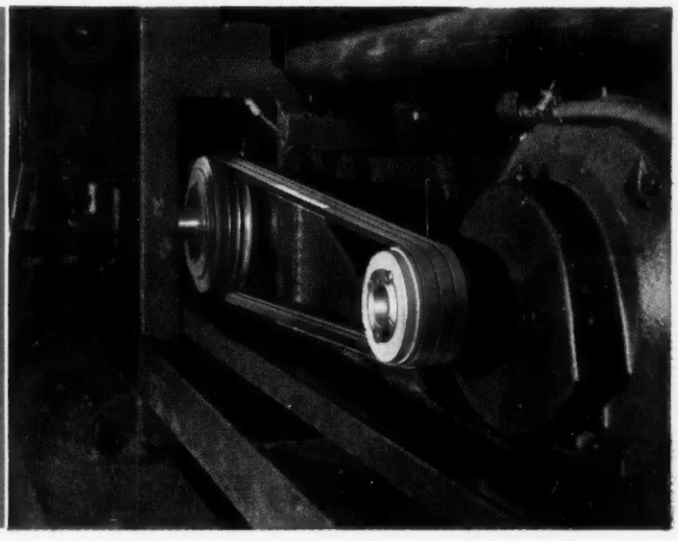

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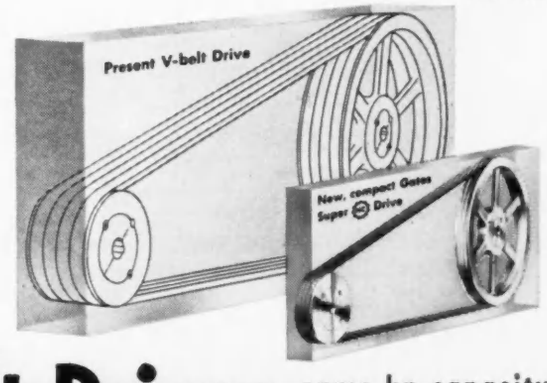

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ver-Julesburg Basin will continue in Colorado and Nebraska. There is some interest in drilling for the Minnelusa formation in Denver-Julesburg. Strong activity will continue on Las Animas Arch and related structural trends, seeking primarily the Kansas City-Lansing oil production discussed by Jewett (extreme northwest Kansas).

Four Corners developments in the Colorado portion of the Paradox Basin are of signal importance, and are discussed below.

Four Corners events. The exploratory outlook for 1960 has been expanded considerably by recent discoveries and extensions both in the San Juan Basin of northeastern New Mexico and southwestern Colorado, and the Black Mesa Basin of northeastern Arizona.

In the San Juan Basin, deeper wildcatting has re-emphasized the importance of Gallup and Dakota (upper Cretaceous) sandstone lenses. These porous lenses offer tremendous potential as stratigraphic traps on the southwest flank of the San Juan Basin.

The Dakota will produce gas and condensate over much the same area covered by shallower Mesa Verde and Pictured Cliffs production. In addition, the Gallup will produce on elongate northwest-southeast stratigraphic trends scattered throughout much of this same area.

The majority of 1960 exploratory drilling in the San Juan Basin will be aimed at deeper Gallup and Dakota stratigraphic traps under and adjacent to present shallower gas production.

In the Paradox Basin of Utah and Colorado, almost all exploratory drilling has been directed toward Pennsylvanian and Mississippian carbonate horizons. A recent discovery in the center portion of the Paradox Basin, north of Pennsylvanian production at Aneth, indicates that Mississippian, Devonian, and possibly Cambrian may become major oil and gas reservoirs in the Four Corners area.

Two important tests by The Pure Oil Company on the Lisbon anticline, San Juan County, Utah, and San Miguel County, Colorado (18 miles apart) found gas and oil in Mississippian beds and in McCracken (Devonian) sandstone at depths expected to range from 7,000 to 9,000 feet. The probable producing area appears to

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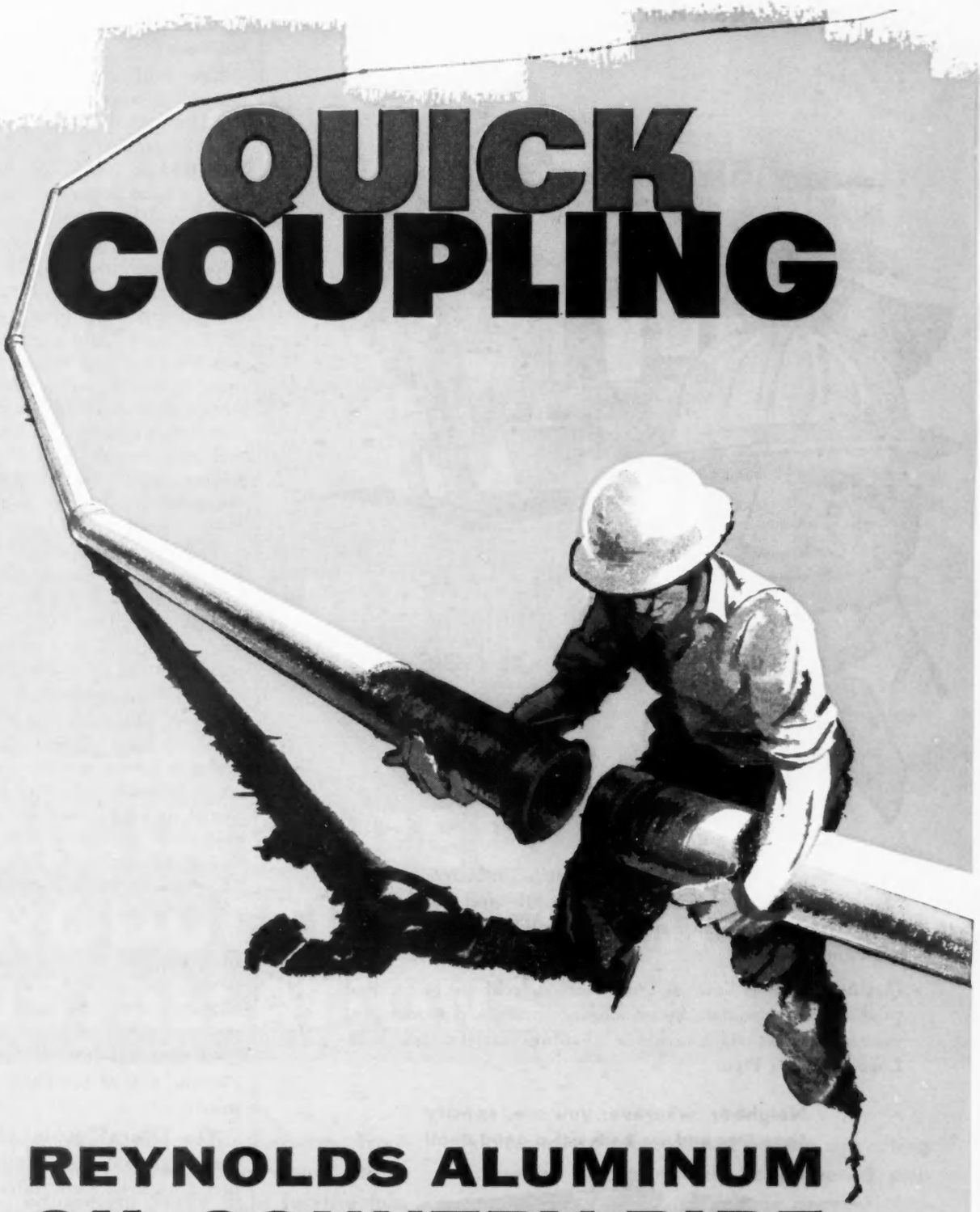

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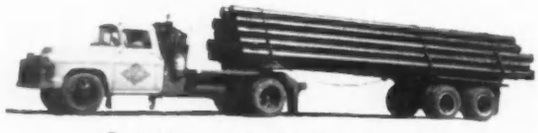

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be some 25 miles from northwest to southeast.

New drilling for sub-Paradox salt horizons is expected to extend from the Utah-Colorado line 125 miles westward, taking in both flanks of the San Rafael Swell, the Kaiparowitz Basin, and as far as the Paunsouquant and Wasatch plateaus.

In the past, the few weak Mississippian discoveries have been discouraging because of low Btu content of the gas and high pour point of the oil. On one of Pure's new wells, cores and tests indicate the probability of more than 400 feet of Mississippian section saturated with gas-condensate. Also, cores and tests in the Devonian and questionable Cambrian indicate the possibility of the first commercial oil production from these zones in the Four Corners area.

The structural feature drilled by Pure is located on the flank of one of the major Paradox Basin salt folds. Extensive faulting and folding associated with salt movement provide many types of structural traps in various Paleozoic formations.

About 120 miles due south, in the northern edge of the Black Mesa Basin, a recent wildcat located on a major structural feature was completed as an oil well in porous Mississippian dolomite. (Harrell Budd, consulting geologist, Farmington, N. M., and Dorsey Hager, consulting geologist, Salt Lake City, Utah.)

In Utah (outside of the Paradox Basin), prospecting in the Wasatch Plateau continues, with many prospects yet undrilled. The same applies both east and west of the Gunnison Plateau, east of the Basin and Range province.

The Uintah Basin, with its one major oil field, Red Wash (200 million barrels of recoverable crude), is also developing into an important gas area. Commercial gas has been developed at Chapita Wells. DeKalb Oil and Gas Company has 8 gas wells and 2 oil wells on its Ute Trail Unit. Together with other fields, there is now enough gas to ensure a line into the area.

Numerous new tests are planned in the Uintah Basin, both for gas and oil. Prospective horizons are Eocene, Paleocene, and upper Cretaceous. Paleozoic beds may be productive

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around the periphery of the Uintah Basin.

Basin and Range province—West Utah and Nevada. This area is less promising. While there are many untested structures, there are only three small wells, located 60 miles southwest of Ely, Nevada, operated by Shell Oil Company. There are three "pays"—one in Miocene pyroclastics, one from Miocene lake beds, and one in Permian limestone. Surely the Shell production in Nevada is not the only oil in such a vast area. (Dorsey Hager, consulting geologist, Salt Lake City, Utah.)

In northern Arizona, some heavy lease plays have developed, due largely to a promising helium find. Only a moderate amount of wildcatting is expected in 1960 in Arizona outside of Four Corners, since prospects are so little known.

CALIFORNIA

Offshore oil, Sacramento Valley gas main targets. Following the pattern of recent years, most of the exploratory effort will be toward extensions of known production and deep tests in established fields.

Offshore exploration has been arduous and expensive. But the success of one drilling venture off the Santa Barbara coast enhanced possibilities greatly. Extensive core drilling, geophysical surveys and interpretation will result in accelerated offshore drilling in 1960.

An increase in wildcatting will also occur in some heavily-populated areas in the Los Angeles Basin, following favorable results at Beverly Hills and Culver City on the Beverly Hills-Newport Uplift.

The south end of the San Joaquin Valley, particularly the North Tejon area, will continue to be a "hot spot" in 1960, among several active localities in this region.

The search for natural gas will be strong in the Sacramento Valley and northernmost San Joaquin Valley. At least one 15,000-foot test (in the old Rio Vista field) is slated for 1960. Success could cause a real burst of deep wildcatting here.

Several wells drilled recently in southeastern Orange county found provocative, if uneconomic, oil accumulations in *Cretaceous* strata. Additional drilling is expected to determine if this play can make money.

Some venturesome operators will try their luck again in the mountainous region between Ventura and the Cuyama Valley.

Extensive leases have been taken in lava-covered areas in Modoc County. Some wildcat drilling, intended to determine the lava thickness and the character of underlying rocks, is expected. (Graham B. Moody, consulting geologist, Berkeley, Calif.)

WASHINGTON STATE

Greater exploratory activity for 1960 is indicated. Near discoveries in Grays Harbor County in 1959 by Tideland Oil and Gas Company and Western California Exploration Company assure additional testing here. However, a decline in drilling is expected in the Chehalis Basin of north central Washington because of three deep dry holes drilled by Shell.

Large lease blocks have been assembled by Humble Oil and Refining Company in Pierce County. Standard Oil Company has leased several structures in the Green River district, King

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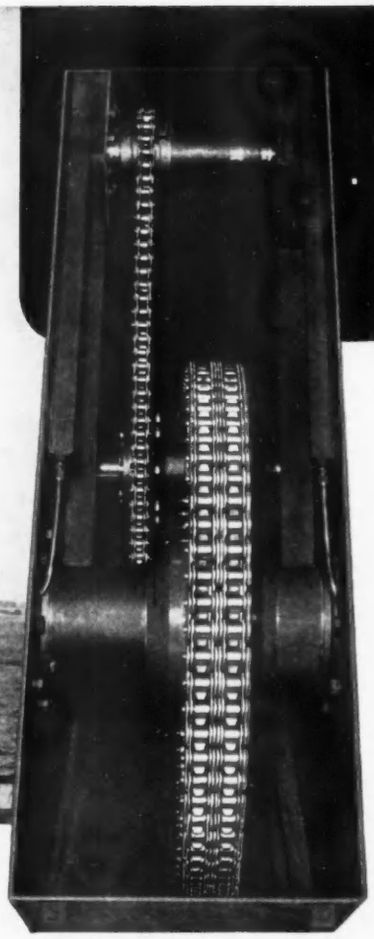

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County. Richfield Oil Corporation has extended a lease play from British Columbia into adjacent Whatcom County. These companies are maintaining exploration crews in the northwest.

Some independent operators are planning lease plays in both Washington and Oregon in 1960. (J. Q. Anderson, consulting geologist, Bakersfield, Calif.)

ALASKA

Interest in Alaska is high, but exploration is hampered by the remoteness and attendant high costs of operations. Uncertain market conditions are also a handicap. A recent natural gas discovery at about 5,000 feet on Kenai Peninsula enhances possibilities there, following development of deep oil pays. A recent discovery in far northwest Canada may enhance certain interior basins in Alaska. But drilling progress will be slow.

MICHIGAN

During its 35-year span as an oil province, most of Michigan's oil production has been from Devonian rocks, and most of the gas has been from the Mississippian. However, the discovery of prolific Trenton-Black River (Ordovician) oil and gas fields in southern Michigan, and Silurian pools in the southwest and southeast have stimulated exploration around the margins of the Michigan Basin.

Devonian areas will receive normal attention in 1960; but late 1959 discoveries in the northwest may excite special interest. However, about 70 percent of wildcats drilled in 1959 were in the southern counties, where such drilling will continue to be strong in 1960 following heavy leasing and geophysical surveying.

See Map on Page 184

Silurian and Ordovician rocks will be the main drilling objectives over most of this region (see WORLD OIL, September 1959, pp. 88-92). The Trenton-Black River formations (Ordovician) should receive vigorous exploration in southern Michigan for pools similar to Scipio, Pulaski, and Albion (see WORLD OIL, October 1959, pp. 136-140). Maintenance of strong activity in this trend depends on location of new fracture trends. (Garland D. Ells, state agency geologist, Lansing, Mich.)

ILLINOIS BASIN

Illinois. Extreme interest in shallow production has been generated recently by a 400 barrels daily wildcat oil well completion in southwestern Brown County at a depth of 600 feet. The flurry of leasing and wildcatting for shallow formations following this event will continue in 1960. The new play points up shallow possibilities on the flanks of the Illinois Basin, and also shows that hydrocarbons may have accumulated at depth in lower Paleozoic formations toward the center of the Basin also.

The Brown County oil strike was made on October 28 by Charles Eager, W. L. Davis 1 near Siloam, southwest of Mt. Sterling. As of December 23, there were about 5 oil wells making a total of about 160

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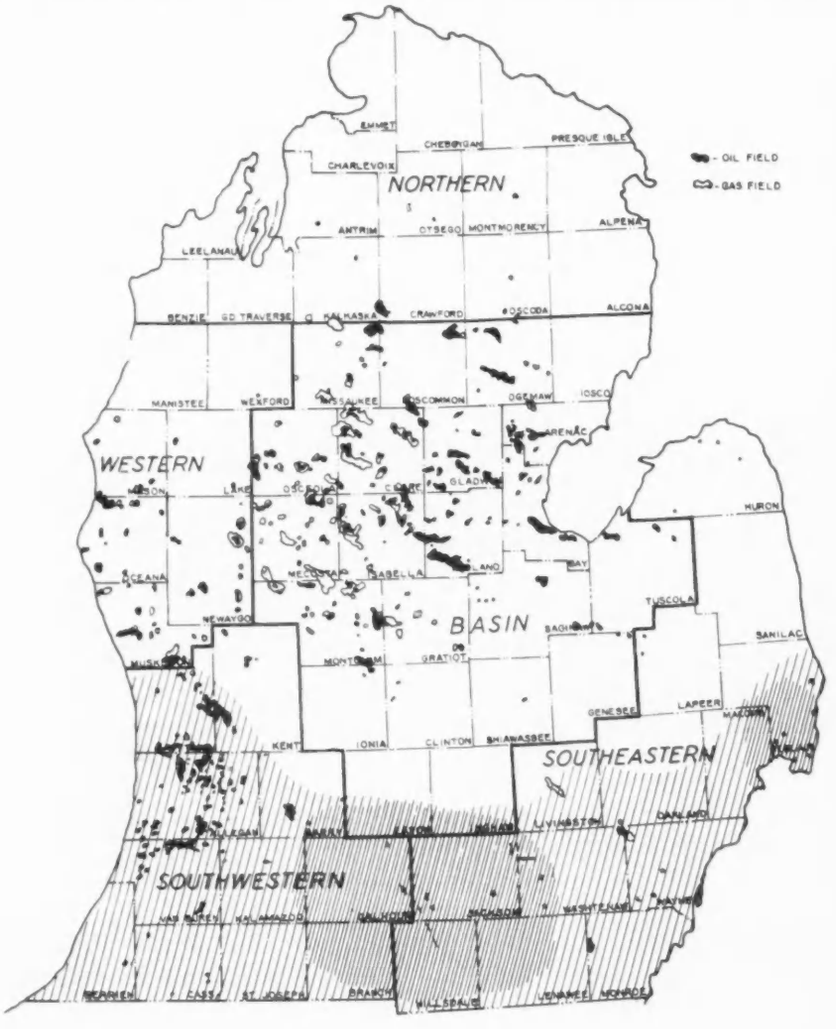

barrels daily plus about 200 barrels of water. Production is from basal Silurian, probably the Edgewood formation. Gravity is about 35° API. Nearby Silurian and Devonian rocks are rather thin and are absent a few miles to the west. Weathering and solution acting upon carbonates may have produced permeability and porosity in these limestones and dolomites.

Later last year, oil was found in Silurian limestone near Rochester in Sangamon County, about 10 miles southeast of Springfield. The deepest producing well in illinois was, as of December 1959, a Dutch Creek sandstone (Devonian) well in Wayne County perforated from 5,319 to 5,326 feet. Some Trenton limestone production in Salem Field, Marion County is lower in the stratigraphic section but at shallower depth than the Dutch Creek production described above. (A. H. Bell, state agency geologist, Urbana, Illinois.)

Western Kentucky is also enjoying vigorous activity, due both to the new shallow find in Illinois, and to the renewed interest in central Kentucky which is spilling over into the Illinois Basin portion of the state.

Indiana. Shallow Chester pays attractive. The area likely to receive the most vigorous exploration activity during 1960 lies east of the older established productive region in Posey and Vanderburgh counties and western Gibson County. The newer region encompasses Spencer and Warrick, eastern Gibson, southern Pike, and southern Dubois counties. Chester

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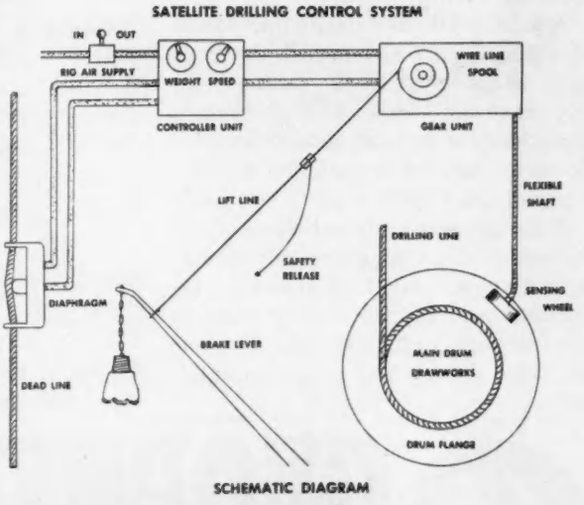

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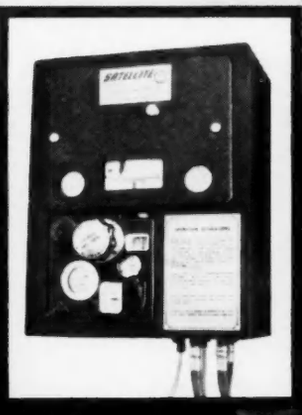

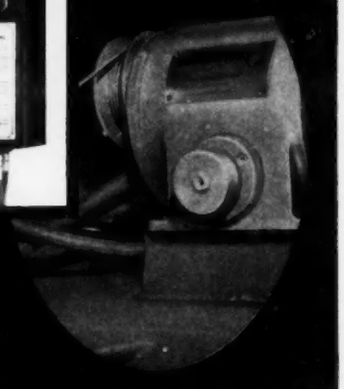

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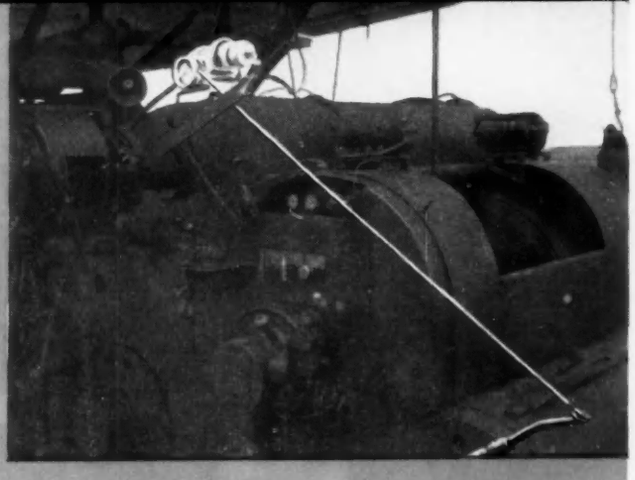

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series (upper Mississippian) rocks occur at shallow depths.

A middle Chester clastic unit called "Jackson," in which sand development is restricted to the shallow east margin of the Illinois Basin, yielded a recent oil discovery in eastern Spencer County. Completion was for 105 barrels daily at 680 feet.

Although many Chester sands are of limited areal extent, they will receive serious consideration because of a favorable ratio of exploratory costs to potential oil yield. (Gerald Carpenter, state agency geologist, Bloomington.)

MANY OPERATORS ENTER APPALACHIANS

Tennessee might experience its greatest oil and gas exploration year in 1960, under the impetus of the Greensburg, Kentucky boom (World Oil, December 1959, pp. 98-101). More than a million acres were under lease in Tennessee at the end of 1959. This acreage is largely restricted to counties adjacent to or near the Kentucky line; i.e., Robertson, Sumner, Macon, Trousdale, Jackson, Clay, Overton, Pickett, and Scott: most of the 1960 drilling activity will take place here. The more important horizons to be tested are Laurel and Brassfield dolomites (Silurian). There will be some Ordovician tests, and a few may penetrate the top several hundred feet of the Knox group.

The upper Cumberland District (Pickett, Fentress, Scott, and Morgan counties) will most likely receive slightly increased attention due to the Kentucky play. This area furnishes almost all of Tennessee's production. The more important pay horizons to be tested are in the Gasper-Ste. Genevieve and Fort Payne formations (Mississippian), although a few Ordovician tests may be completed.

The northern section of the eastern escarpment of the Cumberland Plateau, lying in portions of Anderson, Campbell, and Claiborne counties, will probably enjoy heightened activity due to the recent completion of a small oil well in Claiborne County following gas discoveries in Anderson County a few years ago. Probable pays are in the Mississippian. (Frank M. Alexander, consulting geologist and former state geologist, Nashville, Tenn.)

Central and eastern Kentucky. A survey in November 1959 indicated about 300 active drilling rigs in central Kentucky, including about 50 in Greensburg field and the rest on other scattered tests. Exploratory drilling in Simpson, Allen, Monroe, Barren, Metcalfe, Green, Hart, Larue, Taylor, Nelson, and Hardin counties is expected to continue strong. Some lag is due during the winter months, but as warm weather approaches, an upturn will occur (World Oil, December 1959, Page 98).

Heavy emphasis is being given to Silurian and Mississippian formations on the west side of the Cincinnati Arch. But eastern Kentucky is the scene of much exploratory activity also. Interest continues in Knox dolomite possibilities on and near the crest of the Arch.

West Virginia is presently experiencing a revival of interest by major oil and gas companies. Geological and geophysical exploration programs are progressing on a large scale.

Activity in 1960 will be directed toward the deeper horizons. Exploratory

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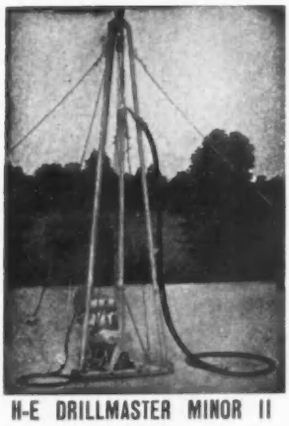

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drilling will trend toward penetration of the Oriskany sandstone; the Clinton formation and dolomites of Silurian age; and the Martinsburg shales, Trenton and St. Peter limestones (Ordovician). Several basement tests will be drilled.

Wildcatting will encompass most of the north central and northeastern portions of West Virginia, with some deep tests being drilled in the counties along the southeastern border. (Byron Finch, consulting geologist, Charleston, W. Va.)

Ohio, especially the eastern third of the state, comprising the western and northwestern shelf areas of the Appalachian Basin, has had an upsurge of leasing activity, subsurface studies, and some geophysical work including airborne magnetometer surveys.

This year should see the drilling of between 5 and 10 basement test wells in Ohio to depths ranging from 3,500 to 10,000 feet. Targets will be middle Ordovician and Cambrian, with the most likely deeper production to be found in the Trenton-Black River *(as in Michigan—Editor's note)*, Glenwood (St. Peter?), Trempealeau (Knox?), and Mount Simon formations. There were two 1959 discoveries in the Glenwood or Trempealeau (at the Cambro-Ordovician contact). One well flowed commercial sweet gas with a small amount of condensate. Another was testing a small show of Corning grade oil in December. Five dry holes were drilled to the Trempealeau in areas of present Silurian or shallower production. In addition, 12 wells have been drilled to basement or metamorphic rocks in central and western Ohio during the past two years, all without finding production.

The "Clinton" (Medina) sand (Silurian) will continue to be the "bread and butter" producing horizon in 1960. Gas reserves of the magnitude of the Jackson-Stark pool (300 billion cubic feet, plus or minus) may be found as a result of increased drilling activity in Portage, Geauga, or Ashtabula counties in 1960. Total number of wells to be drilled will probably exceed 700. (L. R. Kirk, chief geologist, Ohio Fuel Gas Company, Columbus, Ohio.)

Pennsylvania—New York. Strong wildcatting activity is expected to increase on elongate Appalachian structures in northeastern Pennsylvania and contiguous areas in New York State. This is a vigorous gas play for combined structural and stratigraphic traps in the Oriskany sandstone and Onondaga chert (both lower Devonian). Oriskany gas fields found recently may be as long as 30 miles, parallel to the structural axes. Some of the shallower saddles between are found to be ineffective, and Oriskany gas production may extend across them in some cases to the next structure on trend. Reserves of one or more of the new fields may exceed those originally found at Leidy or Driftwood-Benezette.

Among the more active Pennsylvania counties along this trend are Clinton, Centre, Clearfield, Somerset, and Westmoreland. The trend continues into Preston, Tucker and Randolph counties, West Virginia.

—The End

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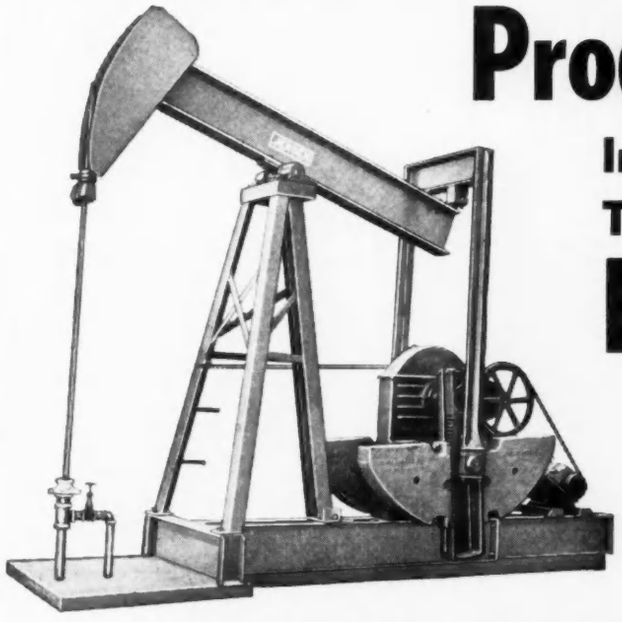

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Well Sample Library Dedicated in Kansas

The Wichita Well Sample Library, providing space for about 50,000 boxes of samples, was formally dedicated recently in Wichita, Kan. Operation and maintenance of the library is directed by the State Geological Survey of Kansas, a division of the University of Kansas.

Office space and microscope are available in the building for sample examination and use of samples is without charge. Donations from all segments of the petroleum industry have made the new facility possible.

The new facility has the most complete Kansas well sample file available for industry use with already about 40,000 sets of samples from all parts of Kansas cataloged. The new library is located in West Monroe, Wichita.

Tennessee Gas Planning South Louisiana Expansion

Tennessee Gas Transmission Company has announced plans for a new South Louisiana headquarters in Lafayette.

The company, through its wholly owned real estate subsidiary, Ten Ten Travis Corporation, has contracted to purchase a 74,000-square foot tract in Lafayette's Oil Center. Plans for a new office building are being drawn and construction will begin soon after acquisition of the site.

The new building will house South Louisiana offices of three Tennessee Gas operating divisions, Tennessee Gas Pipeline Company, Bay Petroleum Company and Tennessee Gas and Oil Company.

Shell Oil to Relocate Two Division Offices

The Shell Oil Company exploration and production division offices, involving more than 240 employes, will be relocated in metropolitan New Orleans this summer after the completion of two new office buildings. Contracts for construction and leasing for the two new buildings have been completed.

The larger of the two structures, to be located on the river side of Veterans Highway about 1,000 feet east of the Causeway Boulevard intersection, will have 30,000 square feet of floor space. It will house about 140 employes of the Southeast Louisiana exploration and land division offices now in Baton Rouge, the production division office now at Donaldsonville and the area production laboratory on Magazine Street in New Orleans.

The other building, to be constructed at the intersection of Sanate and Touro Streets in the Gentilly shopping district, will be the new home for the 107 employes of Shell's Delta production division office now at Westwego, La. It will consist of 60 offices, conference room and service facilities on 20,000 square feet of floor space.

In still another relocation move, Shell's Marine production division will be moved from its present location in the Federal Land Bank Building to the Shell Building in New Orleans.

Pure Oil Company Acquires Woodley Petroleum Company

The acquisition of Woodley Petroleum Company of Houston by The Pure Oil Company has been approved by directors of the major integrated oil firm in Chicago, following a special meeting of the boards of the two companies.

Robert L. Milligan, president of Pure, and J. R. Parten, Woodley president, said that under the purchase plan approved by both boards, Pure will issue 1,193,881 common shares in exchange for substantially all the assets of Woodley. The exchange would be equivalent to 1.4 Pure shares for each of Woodley's 852,772 outstanding shares.

The transaction will include Woodley's interests in three crude oil pipe lines in Saskatchewan and Minnesota, totaling 530 miles, and its 38 percent interest in the Great Northern Oil Company, operator of a refinery at Pine Bend, Minn., near Minneapolis and St. Paul.

Sinclair Oil & Gas Company Combines Southeast Activities

Sinclair Oil & Gas Company, in a move to streamline operations in the southeastern states, has announced it is changing the designation of its office at Jackson, Miss., from division to district. The new Jackson district office will report to division offices in New Orleans, instead of reporting directly to general offices in Tulsa.

According to a statement from Sinclair President William H. Morris, Sinclair will continue its tempo of operations in the southeastern states. Sinclair is combining activities in the southeastern states under one division to permit better coordination and to prevent duplication of effort. Also, no reduction in exploration and production activities and relatively few changes in personnel are anticipated.

The combined division, with headquarters in New Orleans, will direct Sinclair's operations in Florida, Georgia, Alabama, Mississippi, southern Arkansas and most of Louisiana.

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Men in the industry

L. A. Lapham

A. L. Williams

Lewis A. Lapham and **Albert L. Williams** have been elected to the board of directors of the **Socony Mobil Oil Company, Inc.** Lapham is chairman of the executive committee of the Bankers Trust Company, New York. Williams is executive vice president and a director of International Business Machines Corporation, New York.

Forrest M. Darrough, vice president and general counsel of **The Carter Oil Company,** Tulsa, has submitted his resignation and has accepted an invitation to become associate general counsel of the recently organized Delaware corporation, **Humble Oil & Refining Company. Nelson Jones,** of the present Humble Company, Houston, has previously been selected as general counsel for the new company. **D. H. Gregg** will serve as assistant general counsel, **Lee Hill** as associate general counsel, and **Dillard W. Baker** as general attorney. **L. W. Groce, I. D. Breedlove,** and **T. C. Brunson** have been appointed assistant treasurers. **L. H. Thompson, Verne R. Rogers** and **C. N. Bailey** have been named controllers. **Paul Millsapps** has assumed the post of secretary. Groce, Breedlove, Brunson, **Elizabeth H. Kenny** and **J. N. Beasley** will serve as assistant secretaries. **O. E. Roesler** has been appointed cashier, and **J. F. Patton, D. P. Fraser** and **S. E. Bering, Jr.,** assistant cashiers.

Fay T. Anderson has been elected president of **Petro-Atlas, Inc. Dales R. Snow** was re-elected chairman of the board and executive officer.

J. E. Woodward has been named superintendent of operations in **Shell Oil Company's** Houston area Gas Department. He has been serving as superintendent of Shell's Wasson gas plant in West Texas.

John R. Kyte has been named research associate and **Robert C. West** engineering associate in the Production Research Division of **Jersey Production Research Co.,** Tulsa.

D. W. Ramsey, Jr.

D. Woodson Ramsey, Jr., coordinator of the world-wide marketing activities of **Standard Oil Company (New Jersey),** has been invited to join the new **Humble Company** as a vice president and director. Ramsey has been connected with Jersey's marketing operating since 1928.

G. M. Boyer has been promoted to the newly created position of assistant to the vice president in charge of **Continental Oil Company's** Foreign Crude and Products Distribution Department.

Sloan K. Childers has been appointed special representative and **W. W. Dunn** has been advanced to assistant foreign exploration director in **Phillips Petroleum Company's** International Department.

W. M. V. Ash, president of **Shell Oil Company of Canada, Ltd.,** has been appointed vice chairman of HRH The Duke of Edinburg's Second Commonwealth Study Conference.

Robert M. Shepardson has been elected a vice president of **Esso Export Corporation,** international marketing affiliate of **Standard Oil Company (New Jersey).**

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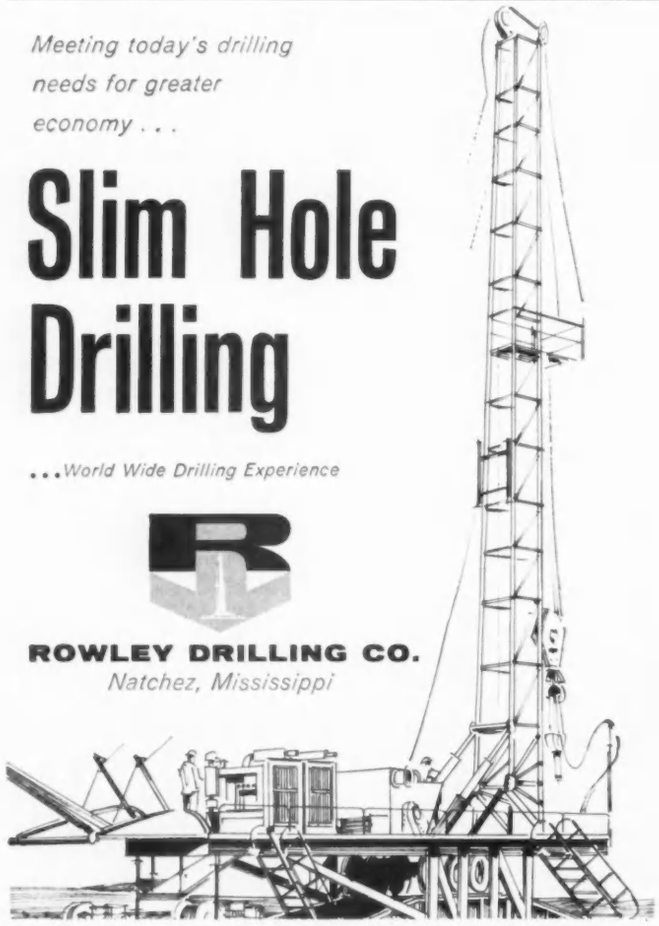

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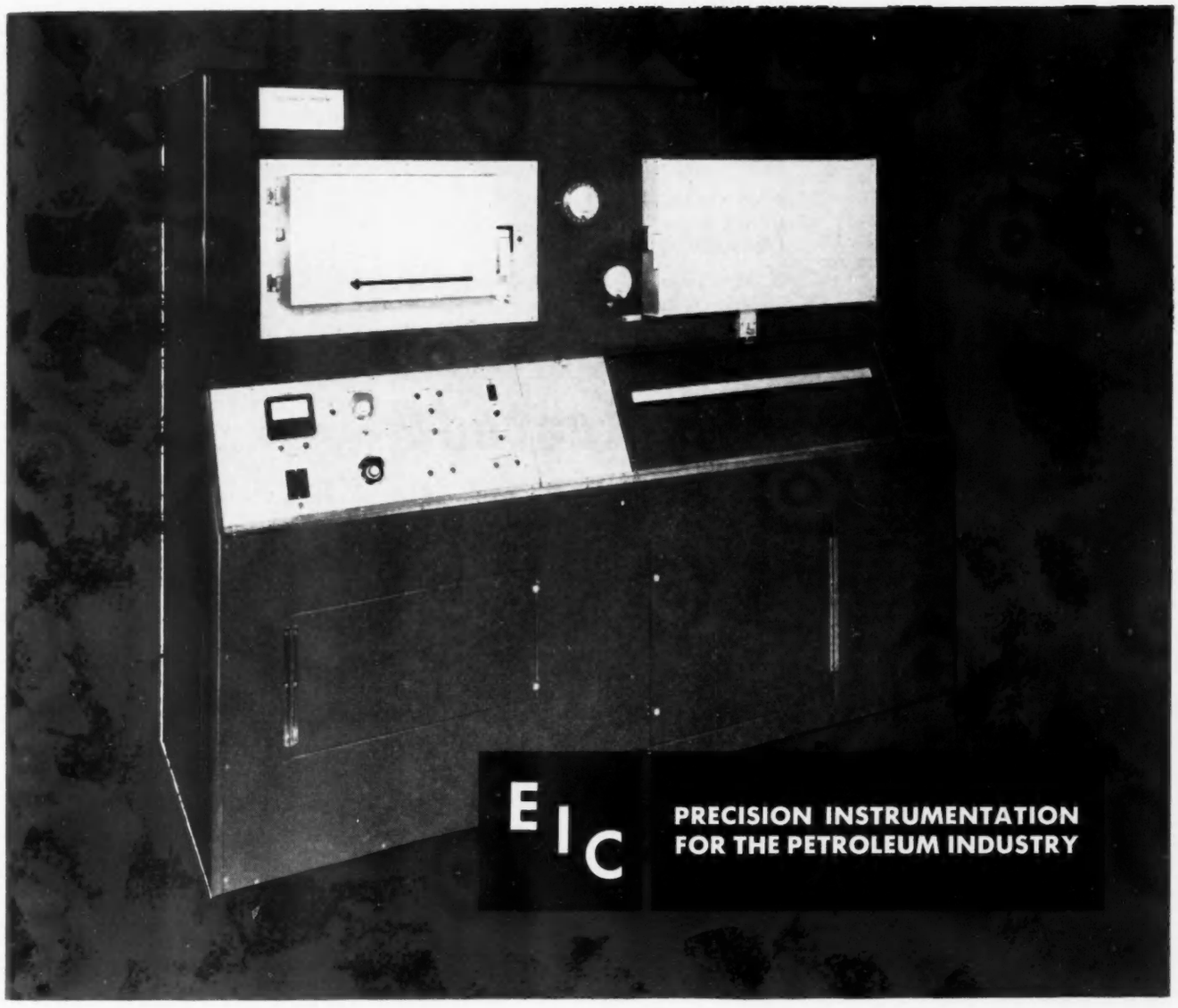

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Men in the industry

J. T. Robichaux has been appointed general superintendent of plants, New York region, for **American Oil Company.** He succeeds the deceased **K. A. Beede.**

James C. Gilbert has been named manager of land and exploration for the **Husky Oil Company.**

Eugene C. Zorn, Jr., has been elected a vice president and economist of the **Republic National Bank of Dallas.**

R. J. Christensen, Tulsa, has been named manager for **Oil Recovery Corporation of New York. Frederick E. Merliss** and **H. J. Ramsay, Jr.,** have joined the organization as manager of research and development and evaluation engineer, respectively.

George W. O'Dair has been elected treasurer and **Leon W. Linebarger** named comptroller, of **Commonwealth Oil Refining Company, Inc.**

Fred A. Davies has been elected to the **Kern County Land Company's Board of Directors.**

N. M. Faulkner, Jr., has been promoted to division landman of the Dallas Division, Domestic Producing Department of **Texaco Inc.** Faulkner succeeds **Homer B. Rainbolt** who has been promoted to a new position in Houston with the Domestic Producing Department.

J. Glenn Cole, geologist, formerly with Amerada Petroleum Corporation, has joined **Apache Oil Corporation,** Denver, in a similar capacity.

J. G. Cole

J. L. Kyser

John L. Kyser has been advanced to manager of **Phillips Petroleum Company's** Supply and Transportation Department. **Harry G. Fair** held this position until his election to vice president earlier this year.

Sanford D. Blattner has been appointed chief geophysicist for **Mobil Oil Company.**

A. E. Collins has been elected a vice president of production, and **L. W. Goudy** a vice president of exploration of **Vickers Petroleum Company.**

Thomas E. Matson has opened his own geologist office in Tulsa in the Thompson Building.

Robert H. Parks, petroleum engineer, has joined the Trust Department of the **First National Bank and Trust Co.,** Tulsa, as a petroleum consultant.

Dr. Shao E. Tung has been promoted to research group leader in the central research division of **Continental Oil Company's** Research and Development Department at Ponca City, Okla.

O. W. Crisman has been named manager of **Delhi-Taylor Oil Corporation's** McAllen, Texas, production district, while **W. S. McCready** has assumed the position of production supervisor in the Dallas headquarters.

George H. Truran of the **Tidewater Oil Company** has been named to the newly created position of division production superintendent.

William I. Patrick has been elected president of **Esso S.A.P.A.** by the Board of Directors, succeeding the retiring **B. G. Tchalidy.**

M. F. Wirges has been appointed chief engineer of **Arkansas Fuel Oil Corporation,** succeeding **L. F. Babcock.**

V. L. Frost, formerly exploration manager of the **Oasis Oil Company of Libya,** a wholly-owned subsidiary of **The Ohio**

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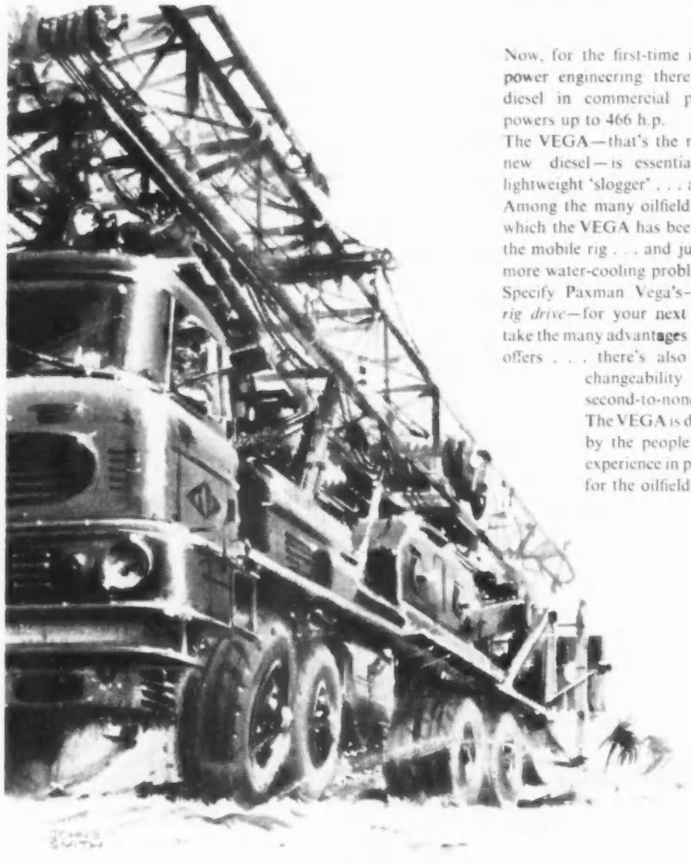

Now, for the first-time in the history of power engineering there's an air-cooled diesel in commercial production, with powers up to 466 h.p.
The VEGA—that's the name of this fine new diesel—is essentially a compact, lightweight 'slogger' . . . and that's a fact! Among the many oilfield applications for which the VEGA has been 'engineered', is the mobile rig . . . and just imagine it, no more water-cooling problems!
Specify Paxman Vega's—*for vehicle and rig drive*—for your next mobile rig, and take the many advantages which the VEGA offers . . . there's also complete interchangeability of parts and a second-to-none field service!
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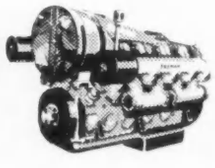

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PO 6

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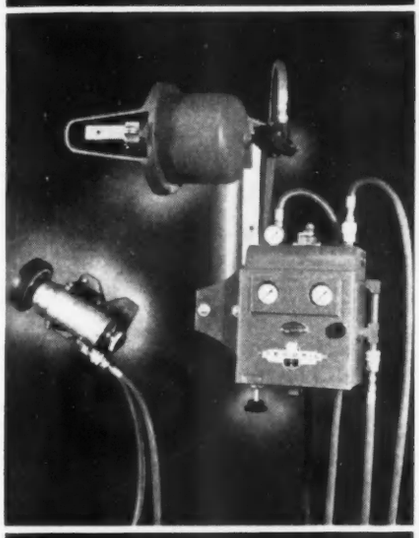

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Men in the industry

Oil Company, has been assigned to the parent company's staff of the manager of exploration for foreign production. He will headquarter in Findlay, Ohio.

Alexander F. Imlay has been promoted to treasurer of **Esso Standard Oil Company.** Formerly assistant treasurer, Imlay succeeds **Lester R. Moore,** now treasurer of **Humble Oil & Refining Co. (Delaware).**

Edward D. Loughney has been elected president and chief executive officer, succeeding **E. D. Brockett,** of **The British American Oil Company Limited.**

W. L. Morris and **A. D. McCall,** petroleum engineers in the Oil Loan Department of the **First National Bank and Trust Company of Tulsa,** have been promoted to assistant vice president by the bank's board of directors.

Barnabas B. Hadfield has been elected a director of **Tidewater Oil Company** filling the vacancy left by the deceased **Gordon B. Crary.**

C. M. Kittrell has been promoted to vice chairman of **Phillips Petroleum Company's** operating committee. He replaces **W. L. Phillips.**

Maury M. Travis, Denver, **David Le-Count Evans,** Wichita, Kan., and **Louis Desjardins,** Tulsa, all petroleum technologists, have become affiliated with **Kornfeld International,** Tulsa-based firm of oil and natural gas consultants.

O. G. Simpson, division production superintendent for **Sinclair Oil & Gas Company** at Midland, Texas, has been appointed assistant division manager at Midland. Simpson succeeds **R. L. Elston** who was elected a vice president and appointed Midland Division manager.

S. T. Algermissen has been appointed assistant professor of Geophysics at the **University of Utah,** Salt Lake City. He was formerly associated with Sinclair Research Laboratories, Inc., Tulsa.

Glen Anderson, Douglas J. Miles and **Thomas H. Philpott** have been elected vice presidents of **Olin Oil & Gas Corp.** Anderson, Miles and **Earl C. Bradbury** also were elected vice presidents of a wholly owned subsidiary, **Olin Gas Transmission Corp.** The directors accepted the resignations of **Walter F. O'Connell** as vice president of both the parent firm and the subsidiary, and appointed him assistant treasurer of both.

M. A. Vaughn has been named assistant division manager, and division geologist at the Evansville, Ind., office for **Phillips Petroleum Company. Vaughn** succeeds **Langley Williams,** promoted to division manager at Billings, Mont.

when you encounter excessive
TORQUE, DRAG
or the hazard of
STICKING
drill pipe and casing

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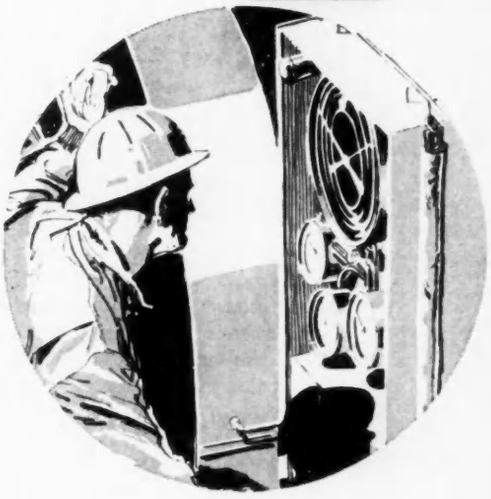

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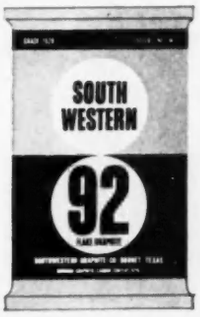

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Wireline Engineers, S. A.
CASPER, WYOMING—C. A. White.....3-5264
CORPUS CHRISTI, TEXAS—Tolle, Inc...TE 5-5367
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HOUSTON, TEXAS
Assoc. Eng. & Eqpt., Inc.....CA 5-1103
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Mid-Western Well Ser. Co.....RE 4-4262
HOUSTON, TEXAS
Long Line Production Co.....GR 3-5739
LAFAYETTE, LOUISIANA
Assoc. Eng. & Eqpt., Inc.....CE 5-6770
Cameo, Inc.....CE 5-3124
LIBERAL, KANSAS—Rainbo Service...Main 4-3598
MIDLAND, TEXAS
Luccous Service & Eqpt. Co.....MU 2-1631
HOUMA, LOUISIANA
Assoc. Eng. & Equip. Inc.....UP 2-0347
ODESSA, TEXAS
Cameo Wire Line Service, Inc.....FE 2-6497
OKLAHOMA CITY, OKLAHOMA
Rainbo Service Co.....ME 4-2131, ME 4-0105
PETTUS, TEXAS
Eddie Jones Eng. Co., Pettus 16, Beeville, FL 8-1218
SHREVEPORT, LOUISIANA—Cameo, Inc....8-3615
VICTORIA, TEXAS—Cameo, Inc.....HI 3-9521
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Men in the industry

F. E. Frey and **A. Clark** have been named senior scientists in the research division organization of **Phillips Petroleum Company. D. E. Carr** has been advanced from assistant director to deputy director of research; and **W. W. Crouch, J. E. Mahan** and **D. C. Smith** have been promoted to assistant directors.

K. W. Brill has been appointed vice president and assistant general manager of **Continental Oil Company's** Rocky Mountain Region with headquarters in Denver.

Gordon M. LaBlanc, president of **Tri-Con Production Corp.,** of Shreveport, La., has been named a member of the Louisiana State Mineral board.

Charles D. Schnake has been named public relations supervisor and **Arnold Young** publications supervisor for **Sunray Mid-Continent Oil Co.,** and subsidiaries.

J. E. Pauley, previously a foreman in **The Ohio Oil Co.'s** Midland, Texas, production district, has been appointed safety engineer for the Houston division, succeeding **R. E. Simon** who has retired.

Claude N. Valerius, consulting geologist of Shreveport, La., has been elected president of the **Shreveport Petroleum Club.** His associates are **Lloyd D. Leeper,** first vice president; **T. W. McGuire,** second vice president; **R. E. O'Brien,** third vice president; **Oma R. Bates,** secretary; and **E. A. Gaston,** treasurer.

Roy M. Mays, Fort Worth, has been promoted to director of reserve and production acquisitions for **Continental Oil Company** with headquarters in Houston. He will direct the acquisition activities which were previously the responsibility of **K. W. Brill,** who recently transferred from New York City to Denver.

Roy M. Mays

Gene Luckemeyer and **Robert Hannifen,** oil scouts, **Continental Oil Company,** Rocky Mountains, have been transferred. Luckemeyer goes from Bismarck, N.D., to Casper, Wyo., while Hannifen moves from Casper to Bismarck.

Ted Amsbaugh, oil scout at Glendive, Mont., for **Shell Oil Co.,** has been transferred to Billings, Mont., replacing **Terry Sherman** transferred from Billings to Bismarck, N.D.

E. D. Brockett has been elected executive vice president of **Gulf Oil Corporation.** He has been president of The British American Oil Co. Ltd., in Toronto, Canada.

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CLEAN OUT CHOKING SAND

Excessive sand and sediment holds back your oil. For fast, easy clean out with fewer round trips and less down-time, use world famous Miller Sand Pumps.

SAND PUMP SIZES
O.D.—2½, 3, 3½, 4¼, 5, 5½, 7 in.
Lengths—20, 25, 30 ft.

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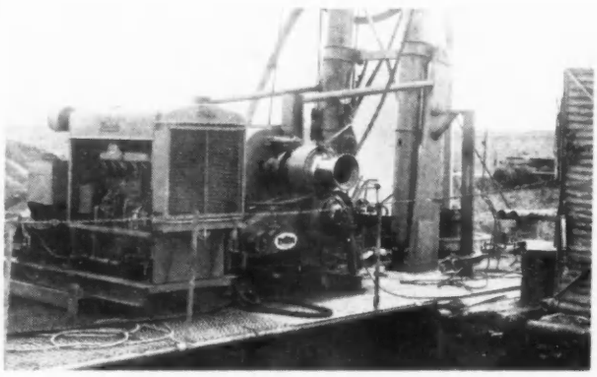
FAST moves!
FAST rigup!



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Manufacturers of Wichtex Servicing Units (2000' to 12,000' capacity) and Wichtex Portable Rotary Rigs

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TENNESSEE GAS TRANSMISSION COMPANY

HOUSTON, TEXAS

DIVISIONS: Tennessee Gas Pipeline Company · Tennessee Gas and Oil Company · Bay Petroleum Company
SUBSIDIARIES: Midwestern Gas Transmission Company · Tennessee Life Insurance Company · AFFILIATE: Petro-Tex Chemical Corp.

Associations

Dallas Landmen's Association Elects Seven New Officers

The Dallas Petroleum Landmen's Association has elected seven new officers for 1960.

Officers elected by the board of directors are: George E. Willin, Jr., trust officer and head of the Oil Division, Trust Department, Republic National Bank of Dallas, president; Eugene H. Gunter, general manager, G. H. Vaughn Interests, first vice president; John W. Storey, regional landman, Sun Oil Company, second vice president; Hunter E. Akard, general agent, Texas Pacific Land Trust, third vice president; James W. Beavers, head of the Land Department, Hunt Oil Company, secretary; James R. Townsend, head of the Land Department, TXL Oil Corporation, treasurer, and William R. Marshall, assistant division landman, Texaco Inc., sergeant-at-arms.

There are some 150 members in the Dallas association, representing independent oil operators and the major oil companies.

Western Oil and Gas Association Elects H. G. Vesper, President

H. G. Vesper

Howard G. Vesper, president of Standard Oil Company of California, Western Operations, Inc., has been elected president of Western Oil and Gas Association, trade association representing the oil industry in the six western states of Alaska, Arizona, California, Nevada, Oregon and Washington. Vesper succeeds Olen Lane of Continental Oil Company.

Other officers elected were Howard C. Pyle, president, Monterey Oil Company, first vice president; George F. Getty II, president, Tidewater Oil Company, second vice president, and T. H. Wallace, vice president, Western Gulf Oil Company, treasurer.

Felix Chappellet was re-elected secretary, vice president and general manager of the Association.

Named as new members of the board of directors were Getty; Ralph Edgington, president, Edgington Refineries, Inc., and Harold C. Morton, partner, Morton and Dolley.

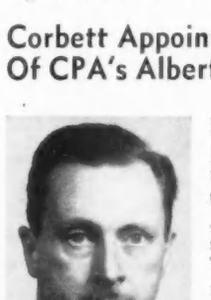
Thomas W. Brinkley Elected AIME International Chairman

Thomas W. Brinkley, chief reservoir engineer for Sunray Mid-Continent Oil Company, has been appointed international chairman of the American Institute of Mining Engineer's production review committee.

Each year the group collects information and publishes a comprehensive report on world-wide production data by individual pool. Brinkley previously served as chairman of the Oklahoma group which covered a five-state area.

Brinkley said that in 1960 the AIME production review group will merge with the National Oil Scouts and Landman's Association and publish a two-volume world-wide production data by individual pool report which will be the most comprehensive study of its kind. Brinkley also directed the production review session at the AIME February annual meeting held in New York City.

Corbett Appointed Manager Of CPA's Alberta Division



J. B. Corbett

James Blakely Corbett has been appointed manager of the Canadaian Petroleum Association's Alberta Division. He succeeds S. Douglas Turner, Alberta, manager for the past five years, who has assumed the duties of general manager of the newly formed Big Inch Pipe Corporation.

More than 1 million tons of mud have been weighed by Mud-O-Graf. This experience has led to the new, foam-proof, lost circulation-proof model.

A complete cycle of weighing is made every 45 seconds. The weighed sample is completely flushed out and passes over the shaker before the next fresh sample is taken.

The recorder can now be installed on the derrick floor without adverse effects from rig vibration on either its remarkable accuracy or its general operation.

Twenty years of experience in the mud weighing business has proved that there is no substitute for a completely accurate, continuous chart record of mud weight *placed in front of the driller.* Check these features:

- A weighing unit that will handle lost circulation material or foamy mud.
- The sample is taken every 45 seconds directly from the mud stream and is not dependent on pumping to a remote location.
- Each sample is completely flushed.
- The weighing unit is smaller and easier to maintain.
- Continuous recording on a circular chart, where a full twenty-four hours is visible to the driller.
- Recording is easily readable and accurate to 1/2 of 1/10 pound per gallon.

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Phone CApitol 4-2511

Lake Charles HEmlock 6-2265
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Suppliers' notes

Jack Hilder

W. M. Marks

E. F. (Gene) Shiels has been promoted to vice president, marketing, for **Ideco, Inc.,** one of the **Dresser Industries. W. M. (Bill) Marks** was promoted to vice president, and **Jack Hilder** to domestic sales manager. Shiels will be responsible for market research, development of new products, sales promotion and advertising. Marks will be responsible for coordination of product engineering and development engineering. Hilder will direct Ideco's domestic sales activities.

E. F. Shiels

Willard Chiasson has been appointed representative for **Gulf Coast Machine & Supply** of Beaumont, at the company's new warehouse and sales office located on the Broussard Highway in Lafayette, La.

Ted C. Graham has been named division sales manager at Calgary, Alb., for **Bethlehem Steel Company's Supply Division.**

Edward G. Crowell has been promoted to assistant vice president and general manager of **Macco Oil Tool Company.** He will headquarter in Houston.

R. E. Dame has been appointed salesman for **Jones & Laughlin Supply Division** at Edmonton, Alta.

Raymond P. Charnaux has been appointed director of foreign operations of **ACF Industries, Incorporated.**

Donald W. Mattimore has been named supervisor of water tube boiler erection for **Springfield Boiler Company.** Springfield Boiler is a subsidiary of **Cleaver-Brooks Co.**

William M. Temple has been named manager of government sales for the **Urethane Division** of **The Dayton Rubber Company.**

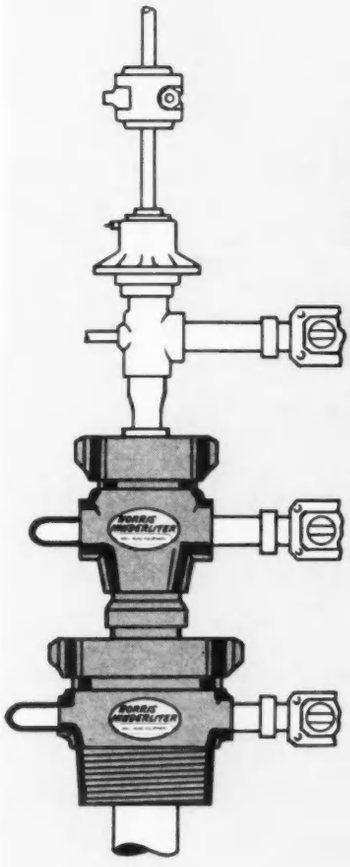
A. G. Lindquist, who has been vice president and treasurer since 1954, was elected financial vice president and secretary of **Gardner-Denver Company.** Also, **Robert H. Meystre** was elected treasurer, reporting to the financial vice president, and **William Miller,** controller, will also report to the financial vice president. **Kenneth J. McDaniel,** who has been secretary, was named president of one of the company's South American subsidiaries, **Gardner-Denver de Brazil, S.A.**

M. C. Niblack has been appointed vice president of sales for **Iverson Supply Company** with offices in Tulsa. **E. L. Lambert** has been advanced to vice president of store and field operations, Midland, Texas, and **Wayne Wallace** was promoted to district manager of the Farmington-Cortez District, Farmington, N.M.

Bill J. Storseth, petroleum engineer, has joined the sales-engineering staff of **Vinson Supply Company** of Tulsa.

Dr. Robert F. Mehl, dean of graduate studies, and head of the Department of Metallurgy at **Carnegie Institute of Technology,** has become a consultant for sci-

Engineered Simplicity



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Write for Well Head Equipment Bulletin for complete information.

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BRANCHES: Great Bend, Kansas; Corpus Christi, Houston, Kilgore, Odessa, Wichita Falls, Texas; Oklahoma City, Oklahoma; Salem, Illinois; Casper, Wyoming; Farmington, New Mexico; Edmonton, Alberta, Canada.

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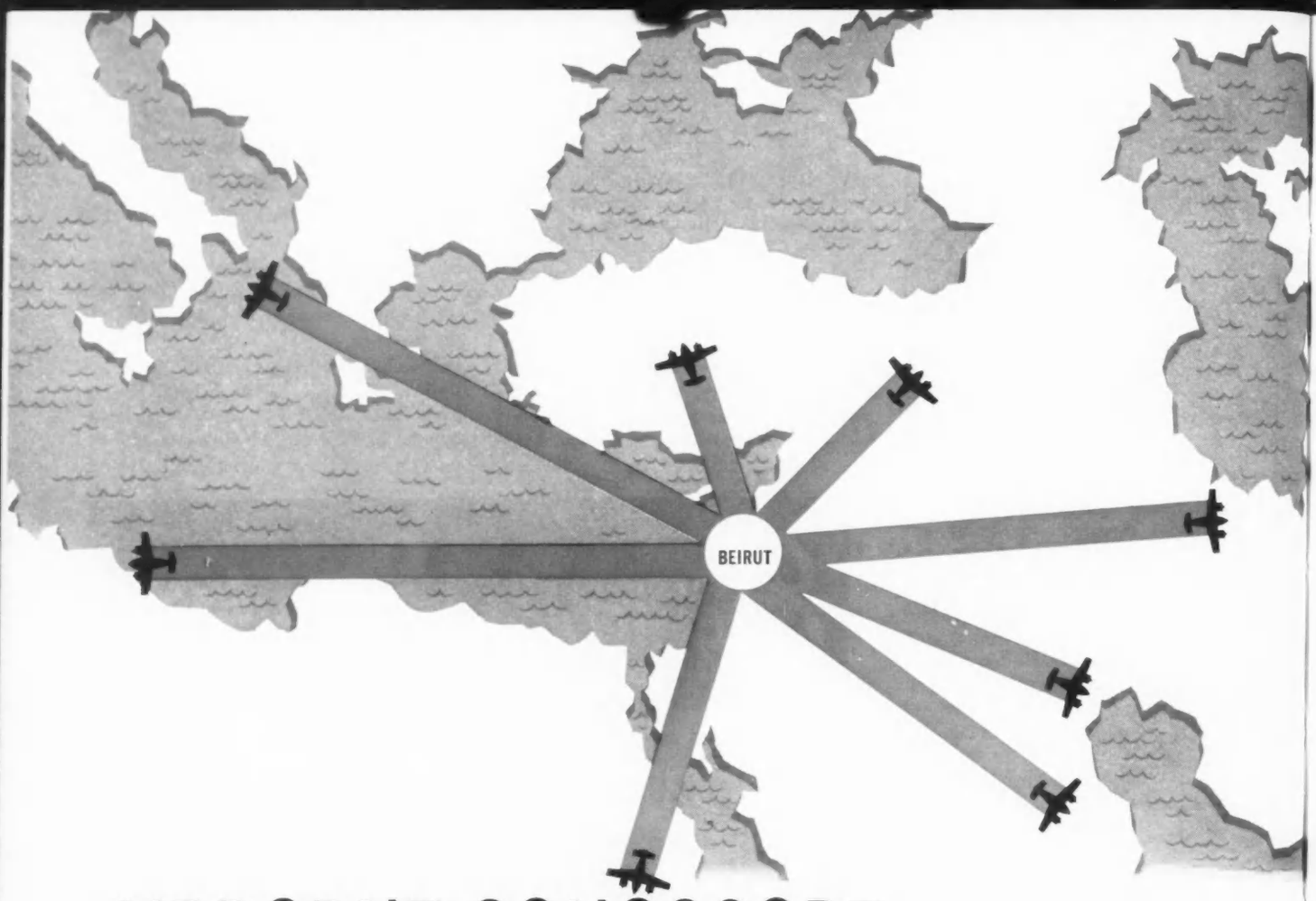

AIRBORNE SONOSCOPE®
Drill Pipe Inspection

Only a few Hours To Mediterranean-Middle East Oil Fields from Beirut

New SONOSCOPE equipment fits in commercial and private aircraft for easy transport. Two men can handle any single unit of the new airborne equipment. Centrally based service with headquarters in Beirut, Lebanon puts SONOSCOPE Inspection Service no more than six hours to all major points of oil operation in the Mediterranean-Middle East areas.

Another Major Technical Breakthrough by The Tuboscope Company

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CABLE ADDRESS "TUBOSCOPE"

Tuboscope® COMPANY

SERVING THE OIL INDUSTRY THROUGH NON-DESTRUCTIVE TESTING

Service Mark Reg. U. S. Pat. Off.

Suppliers' notes

entific liaison between **U.S. Steel Corporation's** research organization and various universities and research institutes in Europe.

Peter De Frank has been appointed manager of research and manager of the Perforation Flow Laboratory for **Jet Research Center, Inc.** De Frank has been with Jet Research since 1955. Prior experience includes several years with Humble Oil & Refining Company, where he was assigned to the drilling, production and well completion and workover sections.

Peter De Frank

P. B. (Pete) Martin has been named Oklahoma-Kansas sales representative for **Liberty Manufacturing Co. of Texas.**

Dewey Adrian Bond has been appointed store manager at Borger, Texas, for the **Oil Well Supply Division of United States Steel Corporation.**

L. E. Blackwell has been appointed a product sales engineer for the Instrumentation Product Group of the **Texas Instruments Incorporated's** Geosciences & Instrumentation Division. He will make his headquarters in Houston.

A. R. Beaulieu has been transferred to **Lufkin Foundry and Machine Company's** New York office. He will direct sales of marine and industrial gears in the eastern region.

Fred W. Dallas, Jr., has been appointed special sales representative for **Security Engineering Division, one of the Dresser Industries.**

J. E. (Ed) Byers has been named regional sales manager of **Black, Sivalls & Bryson, Inc.,** Gulf and Pacific regions. He will direct activities from Alice, Houston, Texas, Los Angeles and New Orleans.

Frank A. Proctor, Jr., has been appointed special sales representative for the Fort Worth-Dallas area for **Rector Well Equipment Company.**

Dougald B. Roy has been named a district sales engineer for the Instrumentation Product Group of the **Texas Instruments Incorporated Geosciences & Instrumentation Division.** His territory will include all of New England.

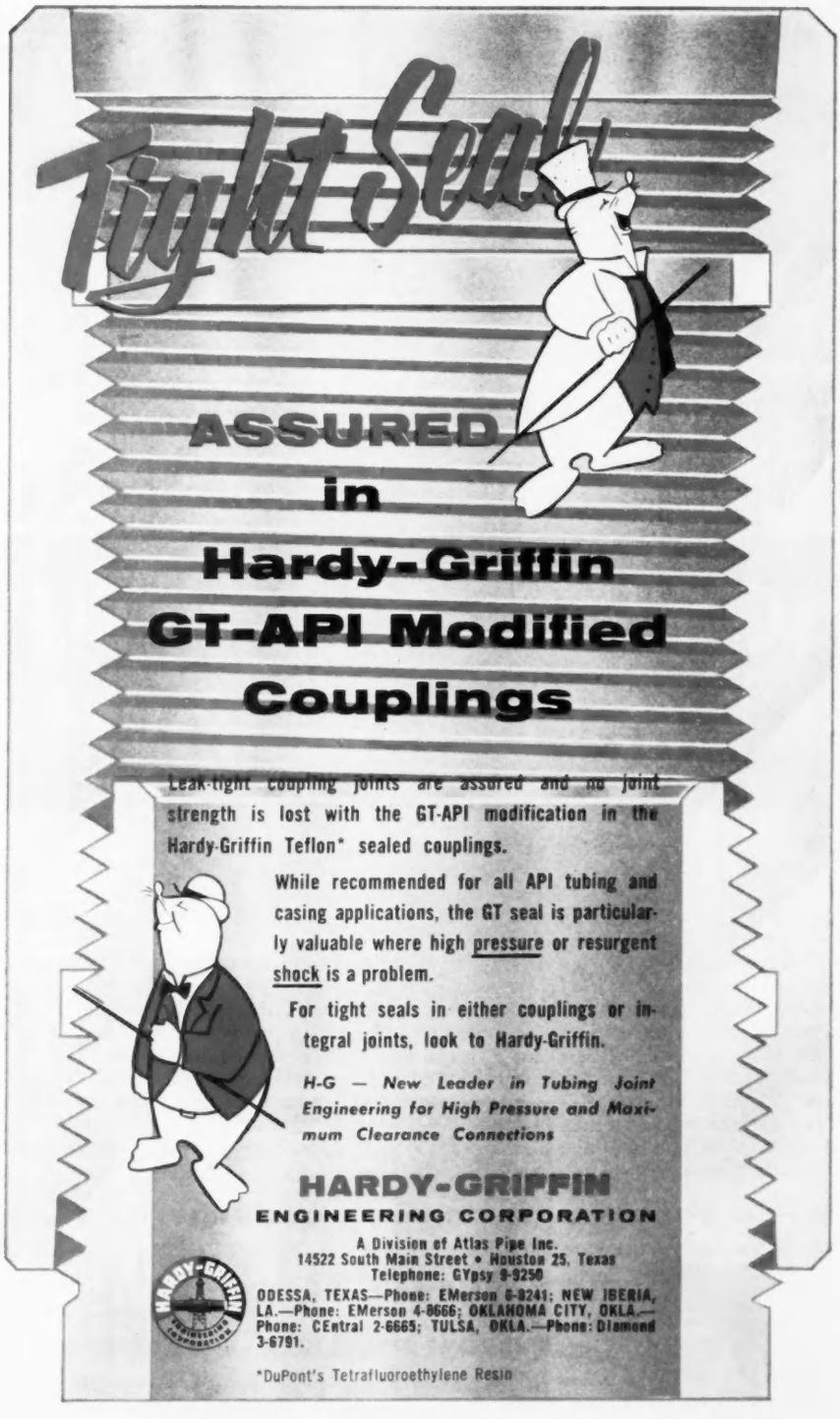
T. E. Obenchain has been promoted by **Schlumberger Well Surveying Corporation** to sales engineer and transferred to Billings, Mont. Also, **C. R. Ferguson** has moved to a sales engineering post at Fort Morgan from Cortez, Colo., and **J. W. Reinders** has transferred to Lubbock, Texas, to fill the position of location manager.

Dick Norton has been transferred to Lafayette, La., to be in charge of the Louisiana sales district for **Drilco Oil Tools, Inc.** Also, **Paul Myers** has been appointed by Drilco to handle sales in the Oklahoma area replacing Norton. Myers will be located in Oklahoma City.

Joseph P. Moran has been made manager of **Dowell** Technical Services and Development Department in Tulsa. Moran, formerly a reservoir engineer in the Company's Chemical Research Laboratory, replaces **J. A. Harmon,** now district manager for Dowell at Amarillo, Texas.

T. V. Hicks, G. O. Languell and **C. E. Love,** service representatives, have been added at the Training Center in Springfield, Ill., by the **Allis-Chalmers Mfg. Co.**

Ralph W. Updegraff has been promoted to the post of general factory manager, Bearing and Rock Bit Division, and **Robert L. Sisson** as general superintendent of the Canton and Gambrinus bearing factories for **The Timken Roller Bearing Company.**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Leak-tight coupling joints are assured and no joint strength is lost with the GT-API modification in the Hardy-Griffin Teflon* sealed couplings.
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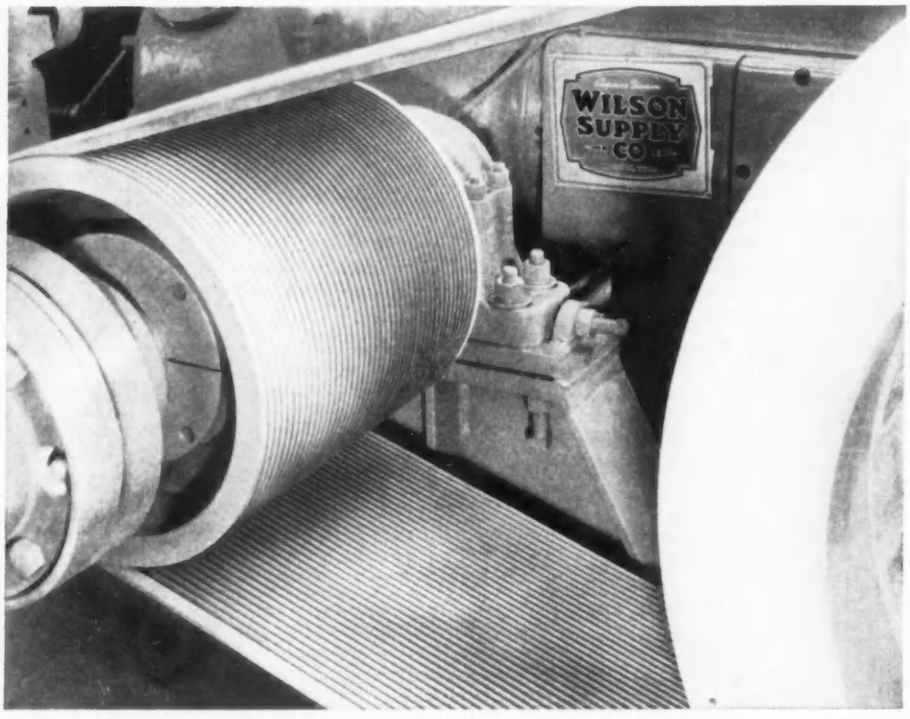
*DuPont's Tetrafluoroethylene Resin

Wherever oil men work, they depend on

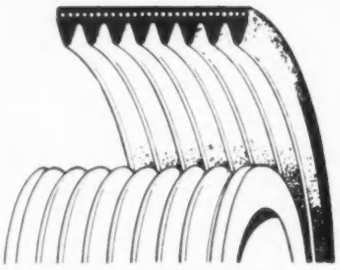


When you change drives...
Don't Settle for *Less* than the BEST

CONVERT TO RELIABLE R/M POLY-V® DRIVE!

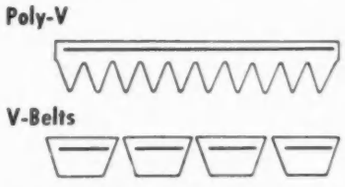
This oilfield compressor drive was rough on V-belts . . . until Wilson Supply Company installed trouble-proof R/M Poly-V Drives on all 200 HP units. Today, R/M's patented, space-saving transmission drive assures a degree of power-packed performance and dependability not possible with any available V-belt drive!

Major causes of V-drive trouble are engineered *out* of Poly-V Drive. It features a single unit, V-ribbed belt—*not* an assembly of V-belts that become unmatched and prevent complete power delivery. Full contact between Poly-V Belt ribs and specially designed sheave grooves keeps belt position constant . . . maintains groove shape and profile regardless of wear—with less wear on belt and sheaves even under toughest drive conditions! Speed ratio is unchanged. And because Poly-V Belt has uniform, uninterrupted strength member across the sheaves, Poly-V Drive will reliably deliver up to 50% *more* power in the same space as a multiple belt drive—or equal power in as little as ⅔ the space!



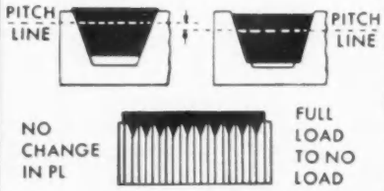
- **ELIMINATES "MATCHING" PROBLEMS**

A SINGLE UNIT across full width of sheave—NOT an assembly of SEVERAL V-BELTS



- **MORE UNIFORM POWER**
- **IN LESS SPACE**

Uninterrupted strength member full width of sheave provides higher horsepower capacity with less stretch —in less space.



- **MAINTAINS GROOVE SHAPE**
- **COMPLETE CONTACT-PRESSURE**
- **MORE CONSTANT SPEED RATIO**

Sheave grooves do not wear out of shape. Full and complete contact-pressure of rubber-to-sheave maintains groove profile. Maintains constant pitch and speed ratio.

..."MORE USE PER DOLLAR"

Let an R/M representative show you how Poly-V* Drive can give you more power delivery, more drive dependability . . . "More Use per Dollar" than the drive you now use. Just two cross sections of Poly-V Belt meet every heavy duty power requirement. Write for Bulletin M141.

WHEN YOU CHANGE DRIVES...CONVERT TO R/M POLY-V DRIVE AND BE SURE!

*Poly-V is a registered Raybestos-Manhattan trademark.

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OTHER RUBBER PRODUCTS FOR THE PETROLEUM INDUSTRY

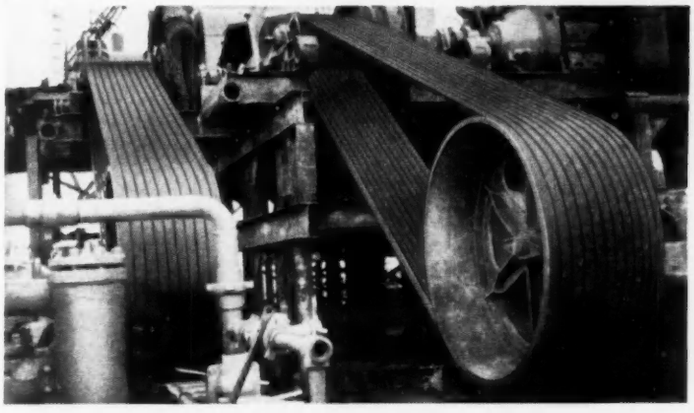
MUD PUMP INTAKE HOSE • VIBRATION HOSE • SHIP AND BARGE LOADING HOSE • TANK TRUCK AND TANK CAR HOSE • PROPANE HOSE • FUEL OIL TRUCK HOSE • FIRE HOSE

R/M Products

RAY-MAN ROTARY HOSE

Strong • Safe • Flexible

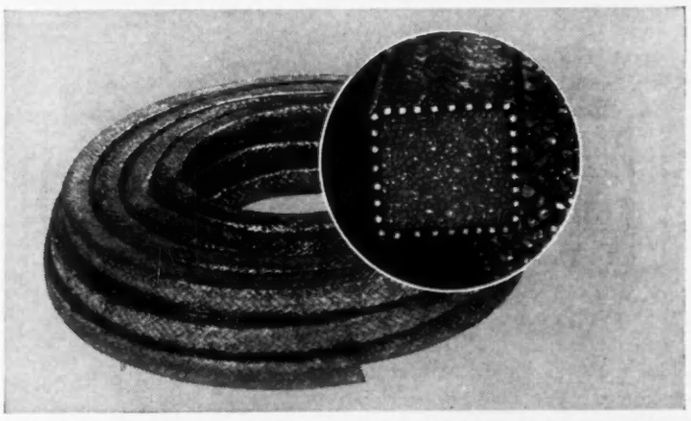
Special high-tensile steel cable wire reinforcement, precision wound under tension, gives Ray-Man CBL Rotary Hose unequalled strength and flexibility for safer, easier handling and make-up on the rig. Resists kinking and accidental crushing in transport . . . holds steadier in the derrick *without whipping*—even under high pressures of deep drilling. Streamlined, built-in coupling has no protruding lugs or flanges—features R/M leak-proof "Lip-Lok" seal that tightens under pressure to prevent blowouts! Write for Oilfield Hose Bulletin M651.



CONDOR LS V-BELTS

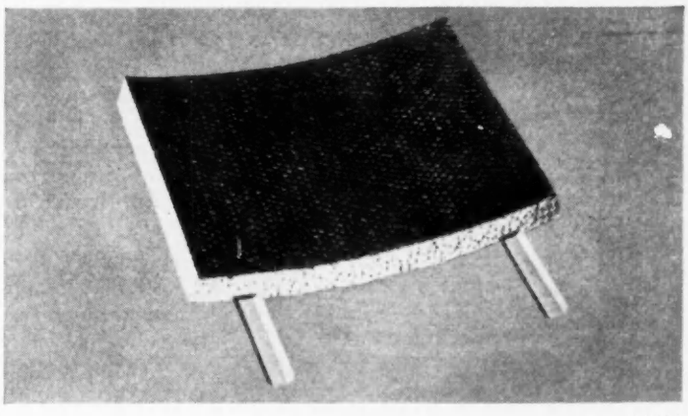
Length Stabilized

No whip, no wobble, no weave—no undue stress or V-belt turnover on long center, heavy duty oilfield drives! Condor LS V-Belts are *length stabilized* to give a degree of lateral and longitudinal stability *without stretch* never before possible. They're length *certified*, too . . . measured, tagged and vacuum packaged to assure positive length control and freshness from factory to field to drive . . . and they now transmit 40% more power than conventional V-belts at no increase in cost! Write for Bulletin M210.



R/M UNIVERSAL PLASTIC PACKING

Made of long-fiber asbestos, a special binder and non-frictional metal, it's the best to use for sealing on centrifugal pump shafts, valve stems, reciprocating rods, and other equipment. Designed specifically for use against gasoline, fuel oil, and other petroleum products. This packing is available in all standard sizes in increments of $\frac{1}{16}$ in., and can be had in both spiral and ring forms, butt or bevel cut.



RAY-MAN BRAKE BLOCKS

Long lasting Ray-Man 635-D Brake Blocks cost less because they wear longer. Made of extra-large asbestos yarns, special saturant, wire reinforced. Resist bleeding, won't glaze or carbonize. Ray-Man blocks are available in drilled or countersunk sets or in the R/M patented Key-Lok style. Patented key-lok gives more friction surface, blocks slide on and off to speed relining. Make hole faster. Cut cost with Ray-Man. Call your nearest R/M warehouse today or contact your closest authorized R/M oilfield equipment supply store located in major oil producing areas.

RM930

RAYBESTOS-MANHATTAN, INC.

PASSAIC, NEW JERSEY

Brake Lining and Blocks • Clutch Facings and Automatic Transmission Friction Parts • Conveyor and Power Transmission Belts Industrial Hose • Rubber Covered and Lined Equipment • Mechanical Packings and Gasket Materials • Asbestos Textiles • Engineered Plastics • Sintered Metal Products • Abrasive and Diamond Wheels • Industrial Adhesives • Laundry Pads and Covers • Bowling Balls

Suppliers' notes

Cameron Iron Announces Proposed Expansion Plans

Cameron Iron Works has announced the proposed expansion of nearly 80,000 square feet of manufacturing area which will give the firm additional space for production of existing and new equipment lines.

The new building will extend the firm's main shop building to the south, and give the company additional space of almost two acres under roof. The total cost of the program was not disclosed, but the building itself will cost an estimated $425,000.

The new shop will be used for the production of valves, blowout preventers, solid block Christmas trees, Christmas tree components, mud gages, weight indicators and flow controllers. The new additions will be completed about the middle of the year.

Howard Supply Co. Named By Bethlehem for Distributor

Howard Supply Company has been named as California distributor of Bethlehem Steel Company's oil field sucker rods.

The 26-year old firm will service California oil fields from its six branch offices and a 10-acre main office located in Los Angeles. A complete size range of sucker rods will be maintained in the oil field distributing company's offices in Oakland, Santa Maria, Bakersfield, Taft, Ventura, Fillmore, Long Beach and Los Angeles.

Besides the sucker rods Howard Supply Company will also carry a complete line of Bethlehem's petroleum pumping units and the Triplex and Duplex piston utility pumps. State-wide service will be a policy of the new distributor.

Shandley Buys Into Rutledge Supply Co.

Acquisition of a half-interest in the Rutledge Diesel Supply Company of Wichita Falls, Texas, by G. B. Shandley, formerly service manager in Houston for Stewart & Stevenson Services, Inc., has been announced.

Shandley acquired the interest from W. E. Rutledge, Jr. The company is a dealer in the Wichita Falls area for Stewart & Stevenson. Rutledge Diesel Supply Company will change its name to R & S Diesel Supply Company.

U.S. Industries, Inc., Acquires Burtonwood Co.

U.S. Industries, Inc., has concluded arrangements for the acquisition of Burtonwood Engineering Company, Limited, of Lancashire, England.

The acquisition gives USI its first wholly controlled manufacturing business in the European market area. The Burtonwood Company, with three plants in England and a subsidiary company in Venezuela, has in excess of 200,000 square feet of manufacturing space under roof and employs approximately 1,000 people.

The Burtonwood acquisition follows the establishment of U.S. Industries, Inc., (Great Britain) Limited, which was formed recently to coordinate the European activities of two major USI division. Burtonwood represents the second step in USI's program for further expansion into world-wide manufacturing and marketing and will offset many of the obstacles frequently encountered by American companies overseas.

Lane-Wells Opens New Location in Kansas

Lane-Wells Company, a division of Dresser Industries, Inc., has opened a new technical oil field service location in Atwood, Kan. The new station offers all the company's newest developments in perforating, nuclear logging, Vibro-Frac, packers and bridging plugs.

This new location is part of the company's expansion program to make its modern oil field services more convenient for operators in areas where the industry is growing as well as in established fields. The new station will serve northwest Kansas and south central Nebraska. Atwood is one of five offices in Kansas which comprise Lane-Wells' Great Bend District. This is the largest of the company's 33 districts.

Your Drill Collars Get Longer Life and

Greater Protection

KOPR-KOTE®

ANTI-SEIZE COMPOUND

MFD. UNDER U.S. PATENT NO. 2,543,741

WORLD WIDE

DRILL COLLARS
Positively prevents seizure and washouts. Insures longer joint life, fewer recuts. Protects threaded connections under any conditions... severe torque, extreme loads, high pressure. Will not compact in threads.

NEW TOOL JOINTS
The perfect break-in compound for new connections.

CASING & TUBING
Unexcelled as a permanent leak-proof thread seal. Assures full makeup without galling.

For Drill Collars, Tool Joints, Casing and Tubing

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CANADA: Jet-Lube of Canada, Ltd., Edmonton
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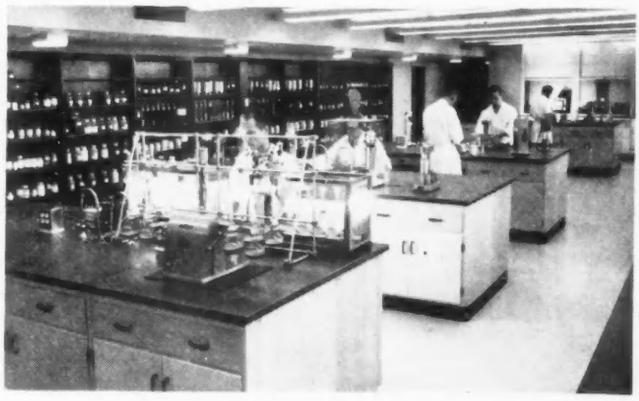
NOW AT LAST THERE

More Milwhite Stock Points

More New Products from Milwhite

IS A DIFFERENCE



More Milwhite Research

More Milwhite Trained Engineers

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More Drilling Benefits
When you Specify
Milwhite Mud Service

MILWHITE

MILWHITE MUD SALES COMPANY

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A DIVISION OF MISSISSIPPI RIVER FUEL CORPORATION

CUT STUCK SAND LINES INSIDE TUBING

KINLEY SAND LINE CUTTER

M. M. Kinley Company, Licensees

ABILENE, TEXAS—Hudson-Eads, Inc....OR 2-5331
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CASPER, WYOMING—C. A. White.....3-5264
CORPUS CHRISTI, TEXAS
Tolle, Inc. .....TE 5-5367, UL 2-1711
GLENDIVE, MONTANA—C. A. White...EM 5-3833
HOBBS, NEW MEXICO
Horne Well Service Co.....3-5396
KILGORE, TEXAS
Davis-Kemp Tool Co., Inc.....5541
LIBERAL, KANSAS
Rainbo Service .....Main 4-3598
LINDSAY, OKLAHOMA
Rainbo Service Co.....PL 6-2530
MIDLAND, TEXAS
Lucceus Service & Eqpt. Co.....MU 2-1631
OKLAHOMA CITY, OKLAHOMA
Rainbo Service Co.....ME 4-2131, ME 4-0105
VIDALIA, LOUISIANA
Davis-Kemp Tool Co., Inc.....435
WHITTIER, CALIFORNIA
Kline Wire Line Co.....OX 3-2731
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Hudson-Eads, Inc. 322-8584
WILLISTON, N. DAKOTA
C. A. White .....GR 3-6555

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Heat and vibration-proof, non-solvent, will not shrink, crack or crumble. Makes all assemblies leak-proof and pressure-tight. Prevents rust, corrosion, joint seizure.

7 BASIC BLENDS

LIQUID WRENCH®
The super-penetrating rust solvent

LOOSENS
rusted bolts, nuts, screws, 'frozen' parts

Liquid Wrench works *fast*...yet is absolutely safe for all metals and alloys.

2171

At Industrial, Automotive, Hardware, Plumbing Jobbers

SOLDER SEAL

RADIATOR SPECIALTY CO.
Charlotte, North Carolina

SQUEAKS
From the Bull Wheel

Silence Is Golden

A movie executive, famous for his long after-dinner speeches, now expresses himself with brevity. Asked to explain his reformation, he replied: "It was a remark I overheard. During a pause in one of my speeches, one man said to another, 'What follows this speaker?' and the other fellow replied, 'Wednesday.'"

What's in a Name

Some years ago the Brown Hotel in Louisville, Ky., adopted the custom of naming a room in the hotel for each winner of the Kentucky Derby. There was a Zev Room, a Gallant Fox Room, a Whirlaway Room, and so forth. After the 1946 Derby, though, the management decided to discontinue the practice. The winner of the Derby that year was Assault.

Light as a Feather

A highway patrolman observed a trucker on the road ahead alight from his cab and with a heavy mallet tap the side of his truck vigorously on all sides and then get back in and drive on. Still following the truck some distance behind, he saw the man repeat the performance. When this happened the third time the patrolman could not withhold his curiosity any longer and stopped the trucker and asked him just what he was doing.

Upon being questioned, the trucker said, "You know just around the next corner is a weighing station?"

"Yes," said the patrolman, he knew there was a weighing station there.

"Well," said the trucker, "I've got a five-ton truck loaded with six tons of canaries and I've just got to be sure a ton of them are still flying when I get to that station."

The Cat's Meow

Steno: "What's your cat's name little boy?"

Boy: "Ben Hur."

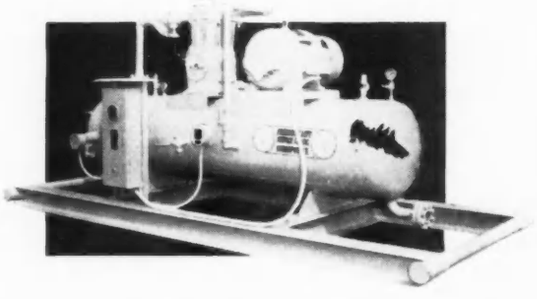
Steno: "That's a funny name for a cat!"

Boy: "Well, we just called him Ben until he had kittens."

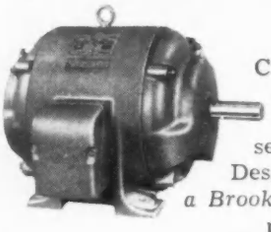
We Have Only Begun to Flight

A none-too-modest hunter, on a hunting trip, took aim and fired, but the bird sailed on undisturbed. The marksman watched it in dazed silence then dashed his gun to the ground and shouted, "Fly on, you blankety-blank fool bird! Fly on with your gol-durned heart shot out."

this unit to "PUSH" OIL OUT OF WELLS is *dependably*



powered by a BROOK MOTOR



The unit shown, built by Pressure Lift Service Co., Inc., Shreveport, La., will "push" the oil up and out of as many as eight wells at one time. *A Brook Open Drip Proof 15 HP a.c. motor* was selected to provide dependable, economical power. Despite their modest cost *there is no finer motor than a Brook.* That is why so many petroleum producers and processors are profiting from *Brook Motors.* All standard enclosures—1 to 600 HP. Send for brochure.

"World's Most Respected Motor"

SINCE 1904

BROOK MOTOR CORPORATION

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250 University Ave., Toronto
Factory Representatives, Warehouses, Dealers, in Principal Cities.

BROOK ELECTRIC MOTORS

Salesmanship
A really good salesman is one who can make his wife sympathize with the girl who lost her compact in his car.

Self Expression
"Grand Coulee," shouted the bishop when he hit his thumb with a hammer.
"Why Grand Coulee?" asked a friend.
"Well," said the bishop, "that's the world's biggest dam."

Political Science
Politician: "My boy says he would like a job in your department."
Official: "What can he do?"
Politician: "Nothing."
Official: "That simplifies it. Then we won't have to break him in."

Never a Dull Routine
"What do you do all day?"
"Hunt and drink."
"What do you hunt?"
"Drink."

From Little Acorns Grow . . .
Out of curiosity, a farmer had grown a crop of flax and had a tablecloth made out of the linen. Sometime later, he bragged about it to a woman guest at dinner. "I grew this tablecloth myself."
"Did you really?" she exclaimed. "How did you manage it?"
The farmer, thinking of having a little fun, lowered his voice mysteriously. If you promise to keep the secret, I'll tell you."
The guest promised.
"Well," proceeded the farmer, "I planted a napkin."

The Bigger They Come
Large Lady: "Little boy, can you tell me if I can get to the park through this gate?"
Little Boy: "I guess so, lady. A load of hay just went through."

Eh, What's Up Doc?
"We'll have to operate," said the doctor. "It'll cost about $1,000."
"But, I haven't got that much money," wailed the patient.
"Okay, let's see what these pills will do for you."

Nothing Ever Changes
"Any big men born around here?" demanded the tourist.
"Nope," returned the native, "best we can do is babies. Is it different in the cities?"

A Member of the Wedding
At a wedding reception, a friend of the groom decided to find out whether anyone in the receiving line knew what the people filing past were saying. As he moved along he said quietly: "My grandmother just died today."
"How nice!" "Thank you so much!" "How sweet of you to say so!" were the responses to his announcement. No one had the slightest idea what he said, least of all the groom, who exclaimed jovially, "It's about time you took the same step, old man!"

SK SPEEDKUT

From Hunt research and advanced engineering—another new product for a better oil industry

Speedkut is the revolutionary new cutting material that sets a new standard of performance for all down-hole cutting operations.
And field operations prove it! For details, just write or telephone any Hunt Tool Company office or field service center.

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HUNT TOOL COMPANY OFFICES: Bay City, Corpus Christi, Gainesville, Tex.; Harvey, Jennings, Morgan City, La.; Liberal, Kan.; HUNT SHIPYARD DIVISION, Harvey, La.; HUNT EXPORT COMPANY, Houston, New York City, Rio De Janeiro, Buenos Aires.

UNION

UNION WIRE ROPE

The *UNIQUE Wire Rope Organization

**Single in Kind or Excellence*

Customers can be credited for Union's outstanding position.

Why? Simply because in large numbers they accepted Union's standing invitation to share their wire rope and sling problems with Union's technical, research and engineering staff.

In meeting these challenges, Union has compiled an outstanding record in wire rope advancements. Some 1600 standard wire rope constructions are in day-to-day production under statistical quality controls which insure "the ultimate low cost rope." This means quality so good that it costs less in the long run.

In searching for better answers to wire rope and sling problems for customers, Union engineers developed the famous family of Tuffy wire ropes and slings.

Rotary drilling called for a special wire rope. There was none until after Union engineers spent many months in the field studying the operation of standard constructions on rotary rigs. Back in the Union laboratories, they researched many constructions to find the special one that performed better, gave longer service life, less down-time and greater safety in rotary drilling. Tuffy Rotary Line proved its excellence and in the proving Union Wire Rope engineers developed the rope saving cut-off procedure now widely followed in rotary drilling.

Tuffy® Rotary Drilling Line

Tuffy Rotary Drilling Lines Are "Ton-Mile Engineered"

Tuffy Standard Rotary Line is "ton-mile" engineered for standard rigs and large jackknife rotary rigs. Tuffy Jackknife Rotary Line is for drilling to 6,000 feet with smaller jackknife rigs.

Union Wire Rope Covers All the Bases In the Oil Industry

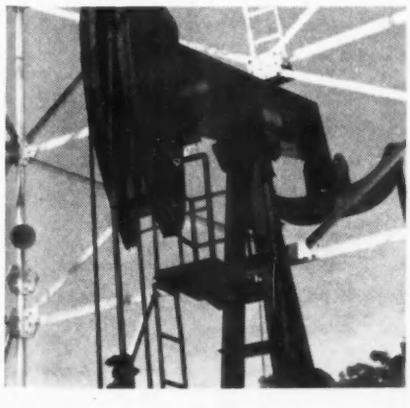
Worthy companions to Tuffy Rotary Line are Union Standard wire ropes for servicing wells. There are 5 constructions for rod and tube pulling and standard constructions of rod hanger line, sand and sand pump line, cable tool drilling line and winch line.

Big Paul, The King of Spades, world's largest electric power shovel. In taking a 105 ton bite (2 rail carloads) it imposes a maximum bail pull upon the wire ropes of 550,000 lbs. One-half mile of wire rope is required in its operation by the Peabody Coal Company at its modern River King Mine, Freeburg, Ill.

Wherever you are in the oil world, Union standard wire ropes and Tuffy Rotary lines are quickly available from leading oil field supply stores. Get service you can rely on. Get the Ultimate low cost wire rope.

Ton Mile Indicator

This slide chart provides you a quick, easy method of figuring ton-miles in following the cut-off practice originally developed by Union engineers. Write Union Wire Rope Corporation, 2104 Manchester Ave., Kansas City 26, Mo.



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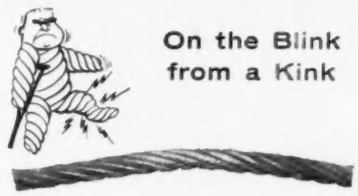
Tuffy Wire Rope Tips on Safe Use of Wire Rope and Slings



On the Blink from a Kink

Mishandling of rope caused this open kink. Avoid kinks by proper winding on the drum. Never pull a loop smaller. Enlarge it, then straighten out the rope.

Overloaded - Soon Exploded

The rated capacity of a wire rope is based on breaking strength divided by the load factor for particular type of service. Grade of steel, type of construction and size of rope determine tensile strength. Unless rope is properly related to loads, costly and dangerous early failures are likely to occur.

Mangled in a Wedge Socket

Here's a result of improper socketing, caused by poorly designed or worn-out wedge socket. Can be costly and hazardous!

Victim of the "Bends"

Excessive bending of rope speeds up wear. General rule: use more flexible ropes as bending stresses increase (with decrease in tread diameter of sheave or drum). If sheaves are too small, early rope failure is certain.

Would you like a copy of a booklet in which more than a score of Tuffy Tips like those above are reproduced. If so, write Union Wire Rope Corporation, 2104 Manchester Ave., Kansas City 26, Missouri.

UNION Wire Rope

Subsidiary of ARMCO STEEL CORPORATION

OTHER SUBSIDIARIES AND DIVISIONS: Armco Division • Sheffield Division • The National Supply Company
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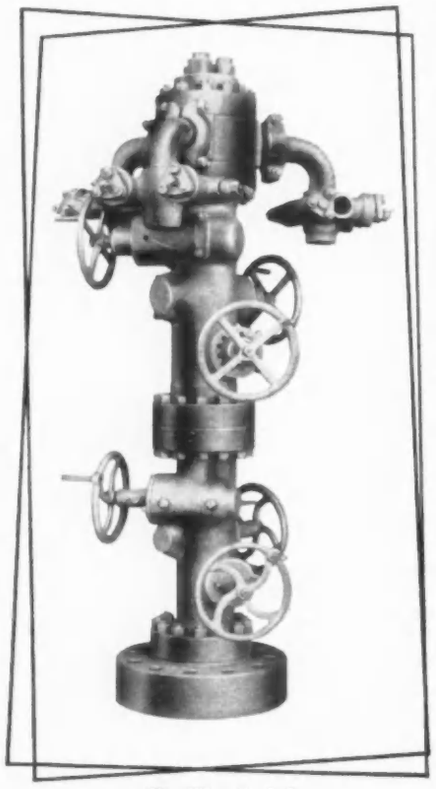

GRAY

Designed Well Control For Complete Safety

Simplified design of Gray Well Control Systems offer maximum flexibility to provide for positive, efficient handling of every well control problem. Parts, creatively engineered to reduce areas subject to pressure, provide *more strength with less weight . . . complete control with complete safety*. Whatever pay zone you're working — deep or shallow, single or multiple zone — you can rely on a Gray Well Control System to give you practical, economical well control safety.

For more information about Gray's Systems of Well Control, see the Gray Catalog in Composite Catalog or write Gray Tool Company.

Safety is Economy

GRAY *Tool Company*

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What's a Little Snake-Bite

A logger, who was a little under the weather, alcoholically speaking, was making his way homeward through a dense patch of brush. Suddenly he heard a rattle at his feet and saw a rattlesnake coiled and ready to strike. The logger drew himself up with dignified solemnity and eyed the reptile with lofty contempt.

"Go ahead and strike," he said scornfully. "Never will you find me better prepared."

Gotta Start Someplace

"Father," asked the newlywed daughter, "can John take the place of your partner who died yesterday?"

"It's OK with me, if he can arrange it with the undertaker."

Cheap, Cheaper, Cheapest

A motorist, touring the deep South, stopped at a filling station in Alabama displaying a big sign: "Mississippi Just Ahead—Last Chance for 28¢ Gas."

When the attendant had filled the car, handed over his change, and was headed back for the station, the motorist called out: "By the way, how much is gas in Mississippi?"

"Twenty-four cents, sir."

The Back-Seat Drivers

There was a terrible crash as the train struck the car. A few minutes later, Mr. and Mrs. crawled out of the wreckage. Mrs. opened her mouth to speak, but her husband stopped her.

"Don't say a word," he snapped. "I got my end of the car across. You were driving in the back seat, and it's not my fault it got hit."

Not Like Back Home

A mountaineer, on his first visit to a city of any size, was fascinated by the asphalt streets. Scraping his feet on the hard surface, he remarked to his son: "Well, I can't blame 'em for building a town here. The ground's too darned hard to plow, nohow."

Ticklish Situation

"I just love goldfish," sighed a gal. "My bathtub is full of them."

"What do you do when you take a bath?"

"Oh," she blushed, "I blindfold them."

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Sonolog
ACOUSTIC WELL SOUNDER

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For determination of liquid level in producing oil wells, static or pumping bottom-hole pressure, productivity index, pump performance, adjustments for gas lifts, etc.

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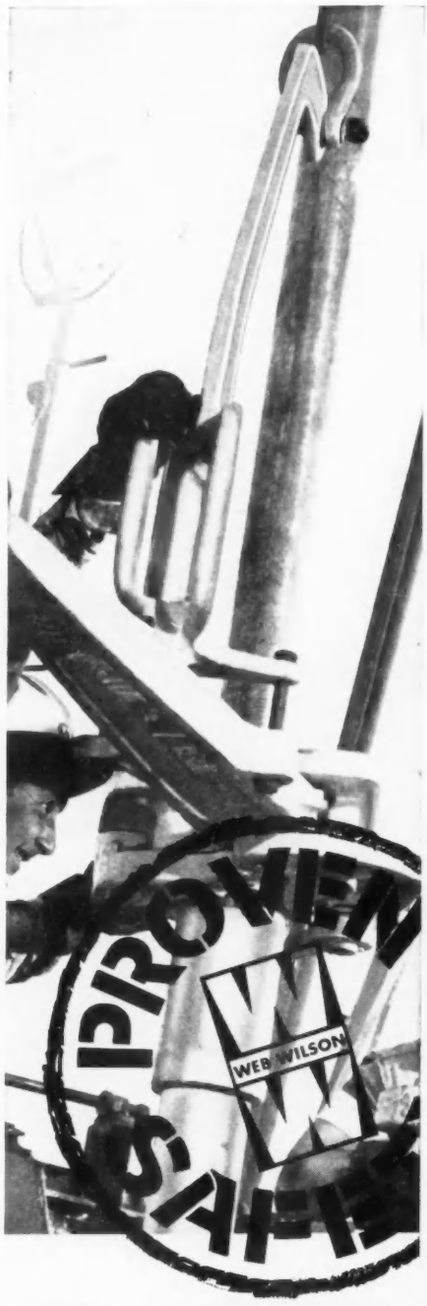

WEB WILSON TONGS

are the *popular* choice of safety-minded operators because of their outstanding record on thousands of rigs the world over! During years of service, these tongs have proven safest to both pipe and crew.

A "spiral" hinge pin design equalizes stresses in all diameter of pipe and prevents crimping, flattening or other damage to pipe. The Web Wilson *exclusive stirrup-type latch* locks securely and cannot open under load.

Web Wilson Tongs are easily and *permanently* balanced; and each will fit many sizes of pipe by substituting a lug jaw.

Is it any wonder these tongs are so popular?